

REPORT ON THE HOLOTHURIANS COLLECTED BY THE  
UNITED STATES FISHERIES STEAMER "ALBATROSS"  
IN THE NORTHWESTERN PACIFIC DURING THE SUM-  
MER OF 1906.

By HIROSHI OHSHIMA,  
Of the Tokyo Imperial University, Japan.

The collection of holothurians made by the United States Fisheries steamer *Albatross* during her cruise in the northwest Pacific Ocean in the summer of 1906 was exceedingly rich. Its study was originally assigned by the United States Bureau of Fisheries to the late Prof. K. Mitsukuri, but after his death in September, 1909, was transferred to the writer. The material was found to be all but untouched by the late professor, only two species of *Molpadia* having been worked out, one of which, *Ankyroderma diomedæ*, was described in his posthumous work, Studies on Actinopodous Holothurioidea.

The specimens contained in nearly 200 bottles and vials are referable to 95 species and 1 subspecies, belonging to 37 genera. The following 3 could not, however, be specifically determined owing to the imperfectness of the specimens or to their young state:

*Pælopatides* (?), sp.  
*Cucumaria*, sp. (juv.).

*Anapta* (?), sp.

The following 46 are new to science:

*Synallactes multivesiculatus*.

*S. gilberti*.

*Bathyplotes östergreni*.

*Mesothuria media*.

*Pseudostichopus aleutianus*.

*Ps. molpadioides*.

*Ps. arenosus*.

*Ps. nudus*.

*Ps. unguiculatus*.

*Capheira mollis*.

*Deima mosaicum*.

*Orphnurgus rigidus*.

*Pannychia moseleyi virgulifera*.

*Ilyodæmon miurense*.

*Peniagone japonica*.

*Achlyonice monactinica*.

*Scotoplanes thééli*.

*Benthodytes gotoi*.

*Molpadia diomedæ* (Mitsukuri).

*M. clarki*.

*M. infesta*.

*Caudina ludwigi*.

*Cucumaria ijimai*.

*C. lamperti*.

*C. spinosa*.

*C. sluiteri*.

*C. constricta*.

*C. globosa*.

*Thyone punctata*.

*Th. parva*.

*Th. bicornis*.

*Th. imbricata*.

*Pseudocucumis dactylicus*.

*Ps. watasei*.

*Ps. sagamiensis*.

*Ps. tabulatus*.

*Phyllophorus cylindricus.*

*Ph. glaucus.*

*Ph. diomedææ.*

*Ph. minutus.*

*Psolidium vitreum.*

*Ps. bullatum.*

*Protankyra kagoshimensis.*

*Tæniogyrus cidaridis.*

*Toxodora pacifica.*

*Myriotrochus mitsukurii.*

The following are reported for the first time from the northwest Pacific:

*Mesothuria murrayi* (Théel).

*Orphnurgus insignis* Fisher.

*Psychropotes raripes* Ludwig.

*Euphronides depressa* Théel.

*Benthodytes sanguinolenta* Théel.

*Molpadia intermedia* (Ludwig).

*M. musculus* Risso.

*M. spinosa* (Ludwig).

*Cucumaria mosaica* Kœhler and Vaney.

*Psolus chitonoides* Clark.

*Chiridota albatrossii* Edwards.

It may be worthy of note that the collection contains three new cases of brooding holothurians, all belonging to Cucumarids, namely, *Cucumaria ijimai*, *C. lamperti*, and *Thyone imbricata*. I may also mention another fact which appears to me to have some significance in connection with the breeding habit, namely, that in some holothurians, such as *Bathyplores tizardi*, ova are found attached about the mouth in the male.

It is also remarkable that in some deep-sea forms the ova are of quite large size, those of *Enypniastes eximia* measuring 3-3.5 mm. and those of *Benthodytes gotoi* and *Euphronides depressa* 2.5 mm. in diameter. They exceed the previous record given by Ludwig for *Benthodytes sanguinolenta* (2-2.2 mm.). Another fact of some interest occurs in some deep-sea forms. That the mesentery of the third limb of the intestine is attached to the body wall along the ventral edge of the right dorsal radial muscle has already been observed by Ludwig in *Benthodytes sanguinolenta*, and the same peculiarity also occurs in several others, such as *Deima mosaicum*, *Pannychia moseleyi virgulifera*, *Ilyodæmon ijimai*, *I. miurense*, *Achlyonice monactinica*, *Scotoplanes thééli*, *Psychropotes raripes*, *Benthodytes gotoi*. This peculiarity seems to be rather common among the Elaspoda.

To the United States Bureau of Fisheries I tender my thanks for permission to work on the valuable collection. I also extend my thanks to Prof. I. Ijima, who has kindly given me a table in his Institute, and to Prof. S. Goto for reading the manuscript and making suggestions. Further I wish to acknowledge my great indebtedness to Miss Mary J. Rathbun who has kindly read the proofs.

Table of stations where *Holothurians* were obtained.

Station No.	Date.	Locality.	Depth in fathoms.	Temperature.	Nature of bottom.	Species.
4767	May 10, 11 May 25 May 30 June 3	Dockton, Puget Sound, Wash. Dutch Harbor, Unalaska Island Unalaska. Nazan Bay, Atka Island Lat. 54° 12' N.; long. 179° 07' 30" E. (approx.)	771	36.5	Green mud	<i>Cucumaria miniata</i> . <i>C. chronichelmi</i> . <i>Cucumaria</i> sp. <i>Chiridota discolor</i> . <i>Cucumaria</i> sp. <i>Cephera mollis</i> . <i>Pseudostichopus aleutianus</i> .
4768	..do.	Lat. 54° 20' 30" N.; long. 179° 09' 30" E. (approx.)	764	37.0	Greenish brown mud, fine black sand	<i>Ps. nudus</i> . <i>Pseudostichopus nudus</i> . <i>Pseudostichopus moseleyi virgulifera</i> . <i>Pseudostichopus nudus</i> .
4769	..do.	Lat. 54° 30' 40" N.; long. 179° 14' E. (approx.)	244	38.5	Gray sand, green mud	<i>Pseudostichopus nudus</i> . <i>Pseudostichopus moseleyi virgulifera</i> . <i>Pseudostichopus nudus</i> .
4770	..do.	Lat. 54° 31' N.; long. 179° 15' E. (approx.)	237			<i>Pseudostichopus nudus</i> . <i>Pseudostichopus moseleyi virgulifera</i> . <i>Pseudostichopus nudus</i> .
4771	June 4	Lat. 54° 30' N.; long. 179° 17' E.	426		Broken shells.	<i>Pseudostichopus nudus</i> . <i>Pseudostichopus moseleyi virgulifera</i> . <i>Pseudostichopus nudus</i> .
4772	..do.	Lat. 54° 30' 30" N.; long. 179° 14' E.	344	38.1	Greenish brown sand	<i>Pseudostichopus nudus</i> . <i>Pseudostichopus moseleyi virgulifera</i> . <i>Pseudostichopus nudus</i> .
4774	..do.	Lat. 54° 33' N.; long. 178° 45' E.	557	37.2	Green mud, black specks, Foraminifera	<i>Ps. nudus</i> . <i>Pseudostichopus nudus</i> . <i>Pseudostichopus moseleyi virgulifera</i> .
4775	..do.	Lat. 54° 33' 30" N.; long. 178° 44' E.	584		Green mud, black specks, Foraminifera	<i>Pseudostichopus nudus</i> . <i>Pseudostichopus moseleyi virgulifera</i> . <i>Pseudostichopus nudus</i> .
4777	..do.	Lat. 52° 11' N.; long. 179° 49' E.	52		Fine gravel	<i>Cucumaria californica</i> . <i>Cucumaria californica</i> . <i>C. lomperthi</i> .
4778	..do.	Lat. 52° 12' N.; long. 179° 52' E.	43	41.0	Fine black gravel	<i>Cucumaria californica</i> . <i>Cucumaria californica</i> . <i>C. lomperthi</i> .
4779	June 5	Lat. 52° 11' N.; long. 179° 57' W.	54		Broken shells, pebbles, sand	<i>Cucumaria californica</i> . <i>C. lomperthi</i> . <i>Psolidium bullatum</i> . <i>Pseudostichopus nudus</i> . <i>Pseudostichopus moseleyi virgulifera</i> .
4781	June 7	Lat. 52° 14' 30" N.; long. 174° 13' E.	482	38.6	Fine gray sand, pebbles	<i>Pseudostichopus nudus</i> . <i>Pseudostichopus moseleyi virgulifera</i> . <i>Pseudostichopus nudus</i> . <i>Pseudostichopus moseleyi virgulifera</i> .
4782	June 8 June 9	Agattu Island Lat. 52° 55' N.; long. 173° 27' E.	57		Rock, gravel	<i>Cucumaria</i> sp. <i>Phyllorhynchus glaucus</i> . <i>Cucumaria californica</i> . <i>C. lomperthi</i> . <i>C. himai</i> .
4784	June 11	Lat. 52° 55' 40" N.; long. 173° 26' E.	135		Coarse pebbles	<i>Cucumaria californica</i> . <i>C. lomperthi</i> . <i>Psolus chitonoides</i> . <i>Cucumaria californica</i> . <i>Cucumaria lomperthi</i> . <i>Cucumaria</i> sp. <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Psolus chitonoides</i> . <i>Psolus chitonoides</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Cucumaria lomperthi</i> . <i>Cucumaria</i> sp. <i>Chiridota discolor</i> .
4786	June 13	Medni Island on fish line	54		Green sand	<i>Cucumaria californica</i> . <i>Cucumaria lomperthi</i> . <i>Cucumaria</i> sp. <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Psolus chitonoides</i> . <i>Psolus chitonoides</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Cucumaria lomperthi</i> . <i>Cucumaria</i> sp.
4788	..do.	Lat. 54° 51' 30" N.; long. 167° 14' E.	57	41.0		<i>Cucumaria californica</i> . <i>Cucumaria lomperthi</i> . <i>Cucumaria</i> sp. <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Psolus chitonoides</i> . <i>Psolus chitonoides</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Cucumaria lomperthi</i> . <i>Cucumaria</i> sp.
4789	..do.	Lat. 54° 50' 24" N.; long. 167° 13' E.	56	41.0		<i>Cucumaria californica</i> . <i>Cucumaria lomperthi</i> . <i>Cucumaria</i> sp. <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Psolus chitonoides</i> . <i>Psolus chitonoides</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Cucumaria lomperthi</i> . <i>Cucumaria</i> sp.
4790	..do.	Lat. 54° 49' 45" N.; long. 167° 12' 30" E.	64	41.0	Pebbles	<i>Cucumaria californica</i> . <i>Cucumaria lomperthi</i> . <i>Cucumaria</i> sp. <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Psolus chitonoides</i> . <i>Psolus chitonoides</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Cucumaria lomperthi</i> . <i>Cucumaria</i> sp.
4791	..do.	Lat. 54° 38' 45" N.; long. 167° 11' 45" E.	64	41.0		<i>Cucumaria californica</i> . <i>Cucumaria lomperthi</i> . <i>Cucumaria</i> sp. <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Psolus chitonoides</i> . <i>Psolus chitonoides</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Cucumaria lomperthi</i> . <i>Cucumaria</i> sp.
4792	..do.	Lat. 54° 36' 15" N.; long. 166° 58' 15" E.	76	42.0	Rocky	<i>Cucumaria californica</i> . <i>Cucumaria lomperthi</i> . <i>Cucumaria</i> sp. <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Psolus chitonoides</i> . <i>Psolus chitonoides</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Cucumaria lomperthi</i> . <i>Cucumaria</i> sp.
4793	..do.	Lat. 54° 36' 15" N.; long. 166° 57' 15" E.	72		Pebbles	<i>Cucumaria californica</i> . <i>Cucumaria lomperthi</i> . <i>Cucumaria</i> sp. <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Psolus chitonoides</i> . <i>Psolus chitonoides</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Cucumaria lomperthi</i> . <i>Cucumaria</i> sp.
4794	June 15	Nikolski, Umnak Island	Shore			<i>Cucumaria californica</i> . <i>Cucumaria lomperthi</i> . <i>Cucumaria</i> sp. <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Psolus chitonoides</i> . <i>Psolus chitonoides</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Synallactes woznawi</i> . <i>Cucumaria lomperthi</i> . <i>Cucumaria</i> sp.

Table of stations where *Holothurians* were obtained—Continued.

Station No.	Date.	Locality.	Depth in fathoms.	Temperature.	Nature of bottom.	Species.
4795	June 20	Lat. 59° 46' 50" N.; long. 158° 44' 30" E.	69	°	Green sand, pebbles.	<i>Cucumaria glacialis</i> .
4798	June 21	Lat. 51° 37' N.; long. 156° 21' E.	25	36.9	Green sand.	<i>Myriotrochus rinki</i> .
	Unknown	Milne Bay, Simushir Island, Kuriles.	Shore.			<i>Cucumaria vegae</i> .
4807	July 6	Mororan, Hokkaido.	44		Shells, coarse gravel.	<i>Cucumaria japonica</i> .
4808	July 16	Lat. 41° 36' 12" N.; long. 140° 36' E.	47		Sand, shells, coarse gravel.	(?) <i>Psolus japonicus</i> .
	do.	Lat. 41° 35' 50" N.; long. 140° 35' 45" E.	47			(?) <i>Psolus japonicus</i> .
4812	July 18	Lat. 38° 33' N.; long. 138° 40' E.	176	34.9	Fine brown mud (?).	<i>Synalactes nozovai</i> .
4813	do.	Lat. 38° 35' N.; long. 138° 41' E.	260	33.9	Brown mud, black sand.	<i>Synalactes nozovai</i> .
4832	July 23	Lat. 38° 14' 30" N.; long. 135° 55' 30" E.	76	53.2	Dark gray sand.	<i>Molpadia roretzii</i> .
	July 24	Tsuruga.	Shore.			<i>Synalactes nozovai</i> .
4875	Aug. 2	Lat. 34° 19' N.; long. 136° 09' E.	59		Fine gray sand, broken shells.	<i>Stichopus japonicus</i> .
4880	Aug.	Lat. 34° 16' N.; long. 130° 16' E.	59		do.	<i>Cucumaria striatula</i> .
4891	Aug. 9	Lat. 32° 27' N.; long. 128° 34' E.	181	50.2	Gray sand, broken shells, rock.	<i>Cucumaria globosa</i> .
4893	do.	Lat. 32° 32' N.; long. 128° 32' 50" E.	106	55.9	Gray sand, broken shells, pebbles.	<i>Bathyplotes ostrigreni</i> .
4895	do.	Lat. 32° 33' 10" N.; long. 128° 32' 10" E.	95		do.	<i>Colochirus dolioalum</i> .
						<i>Cucumaria capensis</i> .
4900	Aug. 10	Lat. 32° 28' 50" N.; long. 128° 34' 40" E.	139	52.9	Gray sand, broken shells.	<i>Pseudocucumis tabulatus</i> .
						<i>Phylloporus minutus</i> .
						<i>Taxoglyphus cidaris</i> .
						<i>Bathyplotes ostrigreni</i> .
						<i>Mesothuria murrayi</i> .
4903	do.	Lat. 32° 31' 10" N.; long. 128° 33' 20" E.	139		do.	<i>Lactmogone sclenakai</i> .
						<i>Cucumaria calcigera</i> .
						<i>C. capensis</i> .
						<i>C. constricta</i> .
4904	do.	Lat. 32° 31' 20" N.; long. 128° 32' 40" E.	107		Fine gray sand, broken shells.	<i>Lactmogone sclenakai</i> .
4906	Aug. 11	Lat. 31° 39' N.; long. 129° 20' 30" E.	369			<i>Pseudocucumis tabulatus</i> .
4907	do.	Lat. 31° 39' 30" N.; long. 129° 24' E.	406	42.6	Gray Globigerina ooze.	<i>Enygnasthes eximia</i> .
						<i>Spharothuria bilineolata</i> .
4913	Aug. 12	Lat. 31° 39' 10" N.; long. 129° 22' 30" E.	391		do.	<i>Enygnasthes eximia</i> .
4914	do.	Lat. 31° 39' N.; long. 129° 29' 30" E.	427		Gray Globigerina ooze, broken shells.	<i>Pseudocucumis dactylicus</i> .
4915	do.	Lat. 31° 31' N.; long. 129° 25' 30" E.	440	41.8	do.	<i>Enygnasthes eximia</i> .
4919	Aug. 13	Lat. 30° 57' 20" N.; long. 129° 10' 30" E.	103	60.6	Globigerina ooze.	<i>Lactmogone violacea</i> .
4935	Aug. 16	Lat. 30° 57' 20" N.; long. 129° 35' 10" E.	103	60.6	Stones.	<i>Colochirus dolioalum</i> .
4936	do.	Lat. 30° 57' 20" N.; long. 129° 37' 30" E.	103	64.8	do.	<i>Thyone punctata</i> .
4937	do.	Lat. 31° 15' N.; long. 130° 38' 10" E.	58	59.8	Mud, lava, pebbles.	<i>Holothuria monacarta</i> .
4940	Aug. 17	Lat. 31° 22' N.; long. 130° 40' 10" E.	115		Brown mud, brown specks.	<i>Stichopus nigripunctatus</i> .
4941	do.	Lat. 31° 22' N.; long. 130° 39' 20" E.	117			<i>Molpadia roretzii</i> .
4945	do.	Lat. 31° 38' 45" N.; long. 130° 45' E.	70	60.4	Green mud.	<i>Protankyra kagoshimensis</i> .



Table of stations where *Holothurians* were obtained.—Continued.

Station No.	Date.	Locality.	Depth in fathoms.	Temperature.	Nature of bottom.	Species.
5017	Sept. 26	Lat. 46° 43' 30" N.; long. 143° 45' E.	64	.....	Brown mud, fine black sand, rock, coral.	<i>Poelus squamatus</i> .
5018	.....do.....	Lat. 46° 41' 30" N.; long. 143° 57' 40" E.	100	30.4	Brown mud, black sand, pebbles.	<i>Chiridota albatrossii</i> .
5020	Sept. 27	Lat. 48° 32' 45" N.; long. 145° 07' 30" E. (approx.)	73	30.9	Green mud, sand, pebbles.	<i>Chiridota albatrossii</i> .
5021	.....do.....	Lat. 48° 32' 30" N.; long. 145° 08' 45" E. (approx.)	73	30.9	.....do.....	<i>Phylloporus cylindricus</i> .
5022	.....do.....	Lat. 48° 33' 30" N.; long. 145° 20' E. (approx.)	109	30.1	Green mud, coarse black sand.	<i>Chiridota albatrossii</i> .
5023	.....do.....	Lat. 48° 43' 30" N.; long. 145° 03' E.	75	30.9	Sand, pebbles.	<i>Thyone imbricata</i> .
5026	Sept. 28	Lat. 48° 36' 10" N.; long. 145° 17' 30" E.	119	30.4	Green mud, black sand, gravel.	<i>Chiridota albatrossii</i> .
5029	.....do.....	Lat. 48° 22' 30" N.; long. 145° 43' 30" E.	440	35.3	Black sand, gravel.	<i>Synalactes nozawai</i> .
5030	Sept. 29	Lat. 46° 29' 30" N.; long. 145° 46' E.	1,800	35.4	Brown mud.	<i>Bathyplotes moseteyi</i> .
5032	Sept. 30	Lat. 44° 05' N.; long. 145° 30' E.	300	34.9	Brown mud, fine black sand, gravel.	<i>Psychropotes rotipes</i> .
5033	.....do.....	Lat. 44° 04' 20" N.; long. 145° 28' E.	533	35.9	Green mud, fine black sand.	<i>Benthodites gotoi</i> .
5036	Oct. 2	Lat. 41° 58' N.; long. 142° 30' 30" E.	464	37.9	Brown mud.	<i>Molpadia musculus</i> .
5039	Oct. 3	Lat. 42° 11' N.; long. 141° 57' E.	326	37.9	Green mud.	<i>Pannychia moseteyi virgulifera</i> .
5043	.....do.....	Lat. 42° 10' 20" N.; long. 142° 15' 20" E. (approx.)	330	37.9	Brown mud, fine black sand, coral, sand.	<i>Scotoplanes thèchi</i> .
5044	.....do.....	Lat. 42° 10' 40" N.; long. 142° 14' E. (approx.)	309	32.1	Gray sand, coral.	<i>Pannychia moseteyi virgulifera</i> .
5045	.....do.....	Lat. 42° 11' 10" N.; long. 142° 12' E. (approx.)	359	38.0	Brown mud, fine black sand, coral, sand.	<i>Chiridota albatrossii</i> .
5046	Oct. 10	Lat. 38° 15' 07" N.; long. 141° 44' 20" E.	82	50.8	Dark gray sand, pebbles.	<i>Synalactes ishikawai</i> .
5046 or 5047	.....do.....	Lat. 38° 12' 50" N.; long. 141° 49' 15" E.	107	49.6	Dark gray sand, broken shells, pebbles.	<i>Synalactes multivesiculatus</i> .
5048	.....do.....	Lat. 38° 09' 24" N.; long. 141° 52' 30" E.	129	40.7	Dark gray sand, broken shells.	<i>Thyone parva</i> .
5051	.....do.....	Lat. 38° 11' N.; long. 142° 12' E.	399	38.1	Dark gray sand, broken shells, Foraminifera.	<i>Phylloporus diomedææ</i> .

5053	Oct. 12	Lat. 34° 49' 20" N.; long. 138° 40' 15" E.	503	34.9	Green mud	<i>Pezoplatides appendiculata</i> .
5054	...do.	Lat. 34° 52' 45" N.; long. 138° 42' 20" E.	282	45.3	Green mud, broken shells, Foraminifera.	<i>Cucumaria spinosa</i> , <i>Sphaerothuria bitenaculata</i> .
5055	...do.	Lat. 34° 53' N.; long. 138° 44' 15" E.	124	56.6	Green mud, gray sand, broken shells, pebbles.	<i>Pseudostichopus trachus</i> , <i>Molpadia roretzi</i> , <i>Sphaerothuria bitenaculata</i> , <i>Thyone multipes</i> .
5057	...do.	Lat. 34° 58' 40" N.; long. 138° 34' E.	270	44.8	Gray mud.	<i>Molpadia spinosa</i> , <i>Sphaerothuria bitenaculata</i> , <i>Thyone multipes</i> .
5059	Oct. 13	Lat. 35° 05' 30" N.; long. 138° 39' 50" E.	297	45.0	Gray sand.	<i>Molpadia roretzi</i> .
5060	...do.	Lat. 35° 06' N.; long. 138° 40' 10" E.	197	50.6	Coarse black sand.	<i>Pseudostichopus trachus</i> .
5067	Oct. 15	Lat. 35° 05' 30" N.; long. 138° 41' 15" E.	293	45.0	Brown sand, broken shells.	<i>Molpadia roretzi</i> .
5069	...do.	Lat. 35° 03' 10" N.; long. 138° 47' E.	131	55.8	Mud, sand, broken shells.	<i>Molpadia roretzi</i> , <i>Pseudocucumis watasei</i> .
5072	Oct. 16	Lat. 34° 44' 55" N.; long. 138° 22' 20" E.	284	44.1	Gray mud.	<i>Amphicyclus japonicus</i> , <i>Bathyploes mosteyi</i> .
5073	...do.	Lat. 34° 46' N.; long. 138° 21' 50" E.	148	54.6	...do.	<i>Molpadia diomedea</i> , <i>Toxodora pacifica</i> .
5074	...do.	Lat. 34° 40' 45" N.; long. 138° 18' 30" E.	47	74.9	...do.	<i>Molpadia antarctica</i> , <i>Cucumaria mosata</i> .
5079	Oct. 19	Lat. 34° 15' N.; long. 138° E.	475	39.1	Pebbles.	<i>Thyone bicornis</i> .
5080	...do.	Lat. 34° 10' 30" N.; long. 138° 40' E.	505	38.7	Fine gray sand, Globigerina.	(?) <i>Cucumaria shiiteri</i> .
5082	Oct. 20	Lat. 34° 05' N.; long. 137° 59' E.	662	37.7	Green mud, fine sand, Globigerina.	<i>Anapta</i> (?), sp. <i>Orphanopus rigidus</i> .
5083	...do.	Lat. 34° 04' 20" N.; long. 137° 57' 30" E.	624	38.1	Fine gray sand, Globigerina.	<i>Latmogone violacea</i> , <i>Pseudostichopus anguliculatus</i> , (?) <i>Pentagone japonica</i> .
5082 5083	...do.	...	...	...	...	<i>Cucumaria shiiteri</i> .
5084	...do.	Lat. 34° N.; long. 137° 49' 40" E.	918	36.8	Green mud, fine sand, Globigerina.	<i>Synalactes gilberti</i> , <i>Pseudostichopus anguliculatus</i> , <i>Deima mosaicum</i> , <i>Pentagone japonica</i> .
5085	Oct. 23	Lat. 35° 08' 45" N.; long. 139° 19' 45" E.	622	37.8	Green mud, fine black sand.	<i>Actinoptice monactinica</i> , <i>Euphronides depressa</i> .
5087	...do.	Lat. 35° 09' 40" N.; long. 139° 19' 05" E.	614	37.5	Green mud	<i>Pseudostichopus trachus</i> , <i>Pseudostichopus anguliculatus</i> , <i>Cucumaria</i> , sp. (juv.).
5088	Oct. 25	Lat. 35° 11' 25" N.; long. 139° 28' 20" E.	369	41.8	...do.	<i>Latmogone violacea</i> .
5090	Oct. 26	Lat. 35° 03' 50" N.; long. 139° 37' 30" E.	290	47.6	Pebbles, black sand.	<i>Hydromon tyman</i> , <i>Pseudocucumis sagamiensis</i> .
5091	...do.	Lat. 35° 04' 10" N.; long. 139° 38' 12" E.	197	47.6	Green mud, coarse black sand, pebbles.	<i>Synalactes ishikawai</i> , <i>S. discoidalis</i> , <i>Bathyploes mosteyi</i> .

Table of stations where *Holothurians* were obtained—Continued.

Station No.	Date.	Locality.	Depth in fathoms.	Temperature.	Nature of bottom.	Species.
5092	Oct. 26...	Lat. 35° 04' 50" N.; long. 139° 38' 18" E.....	70	56.3	Coarse black sand.....	<i>Synallactes ishikawai</i> . <i>Bathyploes moseleyi</i> . <i>Mesoburria parva</i> . <i>Pseudostichopus trachus</i> . <i>Thyodaxmon ijimai</i> . <i>Stichopus nigripunctatus</i> . <i>Molpadia roretzii</i> .
5093	...do.....	Lat. 35° 03' 15" N.; long. 139° 37' 42" E.....	302	43.9	.....do.....	<i>Bathyploes moseleyi</i> . <i>Pseudostichopus trachus</i> . <i>Spharothuria bidentaculata</i> . <i>Synallactes ishikawai</i> . <i>Bathyploes moseleyi</i> . <i>Mesoburria parva</i> .
5094	...do.....	Lat. 35° 04' 42" N.; long. 139° 38' 20" E.....	88	54.8	Black sand, broken shells.....	<i>Pseudostichopus trachus</i> . <i>Thyodaxmon muricase</i> . <i>Stichopus nigripunctatus</i> . <i>Thyone multipes</i> .



## Family SYNALLACTIDÆ Ludwig.

## Genus SYNALLACTES Ludwig.

## 1. SYNALLACTES DISCOIDALIS Mitsukuri.

*Synallactes discoidalis* MITSUKURI, Actinopodous Holothurioidea, 1912, pp. 18-21, text-fig. 3.

Station 5091. Four specimens.

*Habitat*.—Various stations in Sagami Sea (Mitsukuri, 1912); south of Joga Shima, Sagami Sea.

## 2. SYNALLACTES ISHIKAWAI Mitsukuri.

*Synallactes ishiikawai* MITSUKURI, Actinopodous Holothurioidea, 1912, pp. 21-23, text-fig. 4.

Station 5046. One specimen.

Station 5048. Four specimens.

Station 5091. Sixteen specimens.

Station 5092. Twenty-two specimens.

Station 5094. One specimen.

*Habitat*.—Sagami Bay (Mitsukuri, 1912); off Ojika Peninsula; south of Joga Shima, Sagami Sea.

## 3. SYNALLACTES NOZAWAI Mitsukuri.

*Synallactes nozawai* MITSUKURI, Actinopodous Holothurioidea, 1912, pp. 23-25, text-fig. 5.

Station 4788. Two specimens.

Station 4789. Four specimens.

Station 4790. One specimen.

Station 4791. Five specimens.

Station 4792. Ten specimens.

Station 4812. Three specimens.

Station 4813. Three specimens.

Station 4982. Twelve specimens.

Station 4983. Three specimens.

Station 4993. Seventeen specimens.

Station 4994. Eleven specimens.

Station 5029. One specimen.

The species established on a unique specimen is thus represented by 72 specimens in the collection. The largest individual is 290 mm. in length. Color deep violet on dorsum, light brown or whitish on ventrum, papillæ of a lighter color, tentacles yellowish-brown, twenty in number. Pedicels of ventrolateral ambulacra about 70 in each, forming a zigzag row; those of the odd ambulacrum in two zigzag rows, each consisting of about 60 pedicels. Papillæ of dorsum arranged in six rows, of which the median two consist of 30 papillæ each, and the remaining four of 25 each. Quadriradiate tablelike deposits are largest at base of papillæ and pedicels, attaining the

diameter of  $430\mu$ , while those scattered in ventrum and pedicels are smallest, the diameter reaching down to  $50\mu$ . Tentacles are strengthened by bent, cylindrical rods with several short knobs usually in pairs, and perforated with very minute holes at each end.

Except that the dorsal papillæ are arranged in very indistinct rows, *Synallactes challengerii* (Théel) agrees with the present species in every essential character.

*Habitat*.—Hokkaido (Mitsukuri, 1912); Bering Sea; north of Sado Island; west of Hokkaido; off Cape Terpyeniya, Sakhalin.

4. *SYNALLACTES MULTIVESICULATUS*, new species.

Plate 8, figs. 1a-c.

Station 5036. Three specimens.

Station 5046 or 5047. One specimen.

Station 5051. One specimen.

Body slightly flattened, more tapering posteriorly than anteriorly, 250 mm. long and 45 mm. broad. Mouth subventral, anus terminal. Color brown, some with yellowish, others with purplish tinge, ventrum but slightly lighter. Tentacles 20, of intense brown color tinged with red. Pedicels rather few but quite large, 10 mm. long and 5 mm. across at base. The odd ambulacrum has two zigzag rows of about 48 pedicels each; ventrolateral ambulacra each with a zigzag row of 38 pedicels. Papillæ are small, only 8 mm. long at most, having no wartlike base. They form six rows on dorsal side, each row consisting of about 45 papillæ. Tablelike deposits scattered in perisome are similar to those of *S. nozawai*, only differing in being almost exclusively of triradiate type (pl. 8, figs. 1a-c). They are largest near bases of papillæ, with arms attaining the length of  $165\mu$ , and smallest on ventrum, especially on pedicels, with arms measuring only  $35\mu$ . Besides the scattered small tables, a few delicate supporting rods are found in papillæ, and the end-plate is represented by a number of irregularly branched rods. Unlike the papillæ the pedicels contain numerous, very robust rods and a single end plate. Supporting rods of tentacles are similar to those of papillæ. Radial segments of calcareous ring have each a bifurcated, prolonged anterior process. Polian vesicles are of a deep purplish-black color, numbering up to 13. Even in a young specimen 30 mm. long there were found 9 vesicles. Stone-canal situated in dorsal mesentery. Genital tubes branched twice or thrice, forming 2 tufts. Respiratory trees 2, well developed.

Besides the difference in deposits noted above as obtaining between this species and *S. nozawai*, the relation of size and number between pedicels and papillæ is reversed in the two species. *S. chuni* Augustin (= *S. triradiata* Mitsukuri) has triradiate deposits, but the arms of the table are slender and slightly bent, while in the present species they are thick and straight. Moreover, the pedicels are smaller and

much clustered in that species. The presence of as many as 10 or more Polian vesicles is a character which distinguishes the new species from all the others.

*Habitat*.—South of Hokkaido; off Ojika Peninsula, Honshu.

*Type*.—Cat. No. 34143, U.S.N.M.

5. SYNALLACTES GILBERTI, new species.

Plate 8, figs. 2a, b.

Station 4979. Two specimens.

Station 5084. Three specimens.

Body 80 mm. long and 20 mm. broad. Mouth subventral, anus terminal or turned dorsad. Color light gray with slight greenish tinge. Skin smooth to the touch, with thick gelatinous subcutaneous tissue. Tentacles 20. Pedicels of the odd ambulacrum rather scattered, not exceeding 25 in number, arranged in a zigzag or double row. Each ventrolateral ambulacrum has numerous pedicels which form a zigzag row along the margin of sole. There are 4 rows of papillæ on dorsum, each papilla being situated on a conical wart. Papillæ of the outer rows are larger than those of the inner, the wart measuring 4 mm. across and the free filamentous part attaining a length of 7 mm. Each of these rows consists of 12–15 papillæ. Much smaller papillæ belonging to ventrolateral ambulacra form a marginal row along each side. Scattered among these are found appendages of another kind. These are what have been called “Saugfüßchen im engeren Sinne” (Ludwig), or “low whitish warts” (Théel), or “fungiform papillæ” (Mitsukuri). They measure 0.55–1.20 mm. in diameter. Cruciform table-like deposits are uniformly distributed in general perisome. The arms do not meet in one point, but diverge from the ends of a short rod, thus becoming bilaterally symmetrical (pl. 8, fig. 2a). Each arm is perforated with a small hole at the end. Spire is solid and high; the end is divided into 3 long processes which unite again at some distance from the apex and thus give rise to a slitlike hole (fig. 2b). The deposits of ventrum vary in diameter between 60 and 100 $\mu$ , with a mean of about 80 $\mu$ , and the spire 65–70 $\mu$  high. Those of dorsum are 100 $\mu$  in diameter, ranging 77–140 $\mu$ , spire 100 $\mu$  high. Walls of pedicels and papillæ are beset with similar deposits, and a few curved rods are found near tips of pedicels. End-plate is well developed in pedicels but represented by irregularly branched rods in papillæ. The fungiform papillæ are destitute of tables but a branched body represents the end-plate. Supporting rods of tentacles are spinous and arcuate, often armed with some irregular branches. Calcareous ring consists of 10 weakly calcified segments. Polian vesicle single; stone-canal minute, with scattered, irregular latticed deposits in its wall. Genital tubes few in number, branched once or twice.

From *S. ænigma* Ludwig this species differs only in having a visible calcareous ring. *S. crucifera* Perrier, *S. horridus* Kœhler and Vaney, *S. robertsoni* Vaney, and *Bathyplores monoculus* Sluiter are allied to the present species, but in none of them have the fungiform papillæ been described, nor is the arrangement of the pedicels of the odd ambulacrum similar to that in this species. The species is named for Prof. Charles H. Gilbert of Stanford University.

*Habitat*.—South of Totomi, Honshu.

*Type*.—Cat. No. 34144, U.S.N.M.

### Genus BATHYPLOTES Östergren.

#### 6. BATHYPLOTES MOSELEYI (Théel).

*Stichopus moseleyi* THÉEL, *Challenger* Holothurioidea, pt. 2, 1886, pp. 165–167, pl. 10, figs. 19, 20.

*Bathyplores moseleyi* ÖSTERGREN, *Zur Kenntnis der Synallactinæ*, 1896, p. 355.—MITSUKURI, *Actinopodous Holothurioidea*, 1912, pp. 31–35, text-fig. 7.

*Synallactes moseleyi* PERRIER, *Holothuries antarctiques*, 1905, pp. 6–11, text-fig. A. *Synallactes*?, sp. ? AUGUSTIN, *Japanische Seewalzen*, 1908, p. 20.

Station 5029. One specimen.

Station 5072. One specimen.

Station 5091. Fifty-five specimens.

Station 5092. Eighteen specimens.

Station 5093. Two specimens.

Station 5094. One specimen.

I can not find any generic difference between this species and others of the genus. Indeed, the presence of numerous pedicels along the odd ambulacrum is peculiar to the species, and Perrier referred it to *Synallactes* on that account, while Mitsukuri proposed to erect a genus *Östergrenia*. But I prefer to follow Östergren's original diagnosis of the genus, which covers the present species as well as *B. fallax* Östergren. The specimen reported by Augustin from Misaki seems to me to be a macerated one of this species.

*Habitat*.—West coast of Patagonia (Théel, 1886); between Navarin Island and Hoste Island (Perrier, 1905); various stations in Sagami Sea and Uraga Channel (Augustin, 1908; Mitsukuri, 1912); Suruga Bay; off Cape Terpyeniya, Sakhalin.

#### 7. BATHYPLOTES TIZARDI (Théel).

*Stichopus tizardi* THÉEL, *Knight Errant Holothurioidea*, 1882, p. 696.

*Bathyplores tizardi* ÖSTERGREN, *Zur Kenntnis der Synallactinæ*, 1896, p. 354, pl. 13, figs. 36–43.—MITSUKURI, *Actinopodous Holothurioidea*, 1912, pp. 35–39, text-fig. 8.

*Herpysidia tizardi* PERRIER, *Compt. rend. Acad. Sci.*, Paris, vol. 126, No. 23, 1898, p. 1665.

Station 4959. One specimen.

Station 4966. Two specimens.

There is no need to add further details to what is known about this species. I may only mention a fact which seems to have some significance in connection with the breeding habit of the animal. In

the *male*, the mouth is closed by a circular fold of skin, forming, so to speak, a buccal cavity. Many eggs were found attached to the tentacles which were withdrawn into this cavity. The eggs measured 0.9–1 mm. in diameter.

*Habitat*.—Faroe Channel (Théel, 1882); Bay of Biscay (Kœhler, 1895); west coast of Morocco, Sahara, and Senegal (Perrier, 1902); Bergen (Östergren, 1896); Hardangerfjorden (Grieg, 1913); Sagami Sea (Mitsukuri, 1912); southwest of Shikoku; off Kii, Honshu.

8. BATHYPLOTES ÖSTERGREN, new species.

Plate 8, figs. 3a–d.

Station 4893. One specimen.

Station 4903. One specimen.

Body elongated, subcylindrical, only 21 mm. long and 4 mm. broad. Mouth subventral, anus terminal. Color dirty greenish-white. Integument smooth to the touch, with thick gelatinous subcutaneous tissue. Tentacles yellowish, only 19 in number, normal number probably 20. Pedicels none in the odd ambulacrum, in two rows in each ventrolateral ambulacrum. Papillæ forming 6 rows on dorsum. Besides these there are "fungiform papillæ," 0.5–0.7 mm. in diameter, scattered along the sides of body. All these three kinds of appendages are very contractile and not prominent. Quadriradiate tablelike deposits are scattered in all parts of the perisome. In dorsum the deposit has 4 arms, which are expanded and perforated at end, and four-pillared spire with one or two cross-beams and some teeth on the top and sides. Diameter of base varies between 55 and 87 $\mu$ , with a mean of about 70 $\mu$ , and height of spire 33–47 $\mu$ . At the base of papillæ they are very large, with a diameter of as much as 143 $\mu$ , and a spire 70 $\mu$  high, with three cross-beams (pl. 8, figs. 3a, b). In walls of papillæ are found similar deposits with much reduced base and tall spire. Deposits of ventrum are very small and sparse; base usually disklike, pierced by four large holes; spire with one cross-beam (figs. 3c, d); diameter of base varies from 25 to 57 $\mu$ , with a mean of 34 $\mu$ , height of spire 20–23 $\mu$ . Tables in pedicels with many holes in disk, nearly equal in size to those of ventral perisome. Bent supporting rods armed with low spines are also found in pedicels and papillæ. Tip of pedicels with well developed end plate, 200–300 $\mu$  in diameter; papillæ with a cluster of irregular branched rods in tip. "Fungiform papillæ" usually without spicules, but sometimes with a branched rod instead of the end plate. Supporting rods of tentacles with more pronounced spines than in those of pedicels and papillæ. Radial segment of calcareous ring thick, H-shaped; interradials rodlike. Polian vesicles two in one of the specimens, one in the other. Stone-

canal with rather big madreporite not inserted to body-wall. Genital tubes in two tufts; respiratory trees two, well developed.

The present species is very closely related to *B. patagiatus* Fisher, from which it however differs (1) in having fungiform papillæ, (2) in the absence of marginal brim, and (3) in having no C-shaped deposit at all. The species also resembles *B. cinctus* and *B. roseus* both described by Kœhler and Vaney. I take pleasure in naming this species for Dr. A. Hjalmar Östergren of the Zoologiska Station, Kristineberg, Sweden, founder of the genus.

*Habitat*.—Off Goto Islands, west of Kyushu.

*Type*.—Cat. No. 34145, U.S.N.M.

### Genus MESOTHURIA Ludwig.

#### 9. MESOTHURIA MURRAYI (Théel).

*Holothuria murrayi* THÉEL, *Challenger* Holothurioidea, pt. 2, 1886, pp. 185-186, pl. 10, figs. 16-18.

*Holothuria murrayi* (var. ?) THÉEL, *Challenger* Holothurioidea, pt. 2, 1886, pp. 187-188, pl. 9, fig. 3.

*Mesothuria murrayi* ÖSTERGREN, *Zur Kenntnis der Synallactinæ*, 1896, p. 351.—SLUITER, *Siboga* Holothuriën, 1901, p. 24.—FISHER, *Hawaiian Holothurians*, 1907, pp. 683-685, pl. 71, figs. 1, 1a-h.

Station 4903. One specimen.

*Habitat*.—West of Chile (Théel, 1886); off the Strait of Gibraltar (Théel, 1886); southeast of Flores, and Azores (Hérouard, 1902); Flores and Sulu Sea (Sluiter, 1901); Hawaii (Fisher, 1907); off Goto Islands, west of Kyushu.

#### 10. MESOTHURIA PARVA (Théel).

*Holothuria murrayi*, var. *parva* THÉEL, *Challenger* Holothurioidea, pt. 2, 1886, pp. 186-187, pl. 9, fig. 2; pl. 16, figs. 4, 5.

*Mesothuria murrayi*, var. *parva* PERRIER, *Travailleur* and *Talisman* Holothurioidea, 1902, p. 316.—AUGUSTIN, *Japanische Seewalzen*, 1908, pp. 18-20, text-fig. 14.

*Mesothuria parva* FISHER, *Hawaiian Holothurians*, 1907, pp. 686-687, pl. 71, figs. 2, 2a-c.

*Mesothuria deani* MITSUKURI, *Actinopodous Holothurioidea*, 1912, pp. 40-42, text-fig. 9.

Station 5092. Twenty-eight specimens.

— Station 5094. Eighteen specimens.

From the excellent descriptions and figures given by Fisher it is obvious that *M. deani* must be merged with this species.

*Habitat*.—Near Admiralty Island (Théel, 1886); Hawaii (Fisher, 1907); Misaki (Augustin, 1908); several stations in Sagami Sea, Uraga Channel, and Oshima (Mitsukuri, 1912).

#### 11. MESOTHURIA MEDIA, new species.

Plate 8, figs. 4a, b.

Station 4968. One specimen.

Body 30 mm. long, 7 mm. broad, mouth and anus terminal, ventrum flat. Color grayish-white, ventrum a little lighter. Skin strongly

wrinkled, only very slightly rough to the touch. Tentacles 20. Numerous minute pedicels scattered all over the body without any zonal arrangement; they are largest on the ventrolateral ambulacra, being about 0.8 mm. long. Ventrum apparently naked, but the presence of scattered, rudimentary pedicels is indicated by small end-plates. Deposits in the form of tables quite richly present all over (pl. 8, figs. 4a, b). Disk is triangular with rounded angles, with a central hole and six peripheral ones. These latter are most commonly of different sizes, being alternately larger and smaller. Over the central hole is a triradiate arch, each arm of which gives rise to a pillar, united with its fellows by a cross-beam (fig. 4a). In dorsum, disks of tables measure  $66\mu$  in mean diameter, ranging  $45-88\mu$ , peripheral holes 5-8 in number, and height of spire  $40-50\mu$ . Those of ventrum are a little smaller, mean diameter of disks  $54\mu$ , range  $41-65\mu$ , number of peripheral holes 6-10, height of spire  $30-40\mu$ . In pedicels disk of tables is smaller, only  $17-33\mu$  in diameter, peripheral holes being absent; spire  $43-53\mu$  high, pillars not connected by cross-beams; no supporting rods, but the end-plate well developed with a large central hole. Rods in tentacles slender and bent, with numerous spines, often branched. Calcareous ring well developed. Polian vesicle single, stone-canal ending in a large ellipsoidal madreporite, which does not lie in dorsal body-wall. Genital tubes twice dichotomously divided, forming a tuft on the left side of dorsal mesentery.

It seems to me highly probable that in Perrier's genus *Zygothuria*, there may be indications of the presence of ventral pedicels, as in the present species. *M. multipes* Ludwig and *M. incerta* K  hler and Vaney differ from this species in details of deposits. The present species also closely resembles *M. abbreviata* K  hler and Vaney, which is somewhat imperfectly known.

*Habitat*.—Off Kii, Honshu.

*Type*.—Cat. No. 34146, U.S.N.M.

#### Genus PSEUDOSTICHOPUS Th  el.

##### 12. PSEUDOSTICHOPUS TRACHUS Sluiter.

*Pseudostichopus trachus* SLUITER, Tijdschr. Ned. Dierk. Ver., Dl. 7, Af. 1, 1901, pp. 15-16; *Siboga* Holothurien, 1901, pp. 52-53, pl. 5, fig. 1; pl. 8, fig. 8.—MITSUKURI, Actinopodous Holothurioidea, 1912, pp. 3-9, pl. 1, figs. 1-5, text-fig. 1.

- Station 4968. One specimen.
- Station 5055. Five specimens.
- Station 5060. One specimen.
- Station 5092. Fifty specimens.
- Station 5093. One specimen.
- Station 5094. Seven specimens.

Of these 65 specimens the largest measures only 70 mm. in length. In these specimens as well as in those examined by Professor Mit-

sukuri, end-plates are present in pedicels in most cases. They are rudimentary and are irregularly perforated, measuring at most 0.1 mm. in diameter. Besides the smooth, latticed plates in perianal region there are scattered smaller spinose bodies.

*Habitat.*—Moluccas and Timor (Sluiter, 1901); Sagami Sea (Mitsukuri, 1912); Suruga Bay; off Kii, Honshu.

13. PSEUDOSTICHOPUS ALEUTIANUS, new species.

Plate 8, figs. 5a-c.

Station 4768. Seventy-six specimens.

Station 4774. Three specimens.

Body flat and elongated, 73 mm. long, rounded at both extremities. Mouth ventral, anus lodged in a vertical pygal furrow. Body is thickly coated all over with sponge spicules and foraminiferan shells. Tentacles 20. Pedicels of ventrolateral ambulacra largest, about 1 mm. long, forming a double row. Scattered smaller papillæ (?) forming a double row along each dorsal ambulacrum. Scattered on the midventral ambulacrum, as well as on all interambulacra, are found very minute pedicels. X-shaped spicules present in wall of genital tubes, as in *Ps. occultatus* v. Marenzeller (pl. 8, fig. 5a). They vary in size from 60 to 150 $\mu$ . Around the anus are thinly scattered, irregular, X-shaped spicules (fig. 5b) and also irregularly rod-shaped ones (fig. 5c). Their length varies from 80 to 200 $\mu$ . Larger pedicels have end-plates attaining the diameter of 80 $\mu$ . Supporting rods of tentacles slender and bent, with low processes and often slitlike perforations. No deposits whatever are found in general perisome nor in respiratory trees. Calcareous ring similar to that of *Ps. trachus*. Polian vesicle single. Genital tubes not divided, in two tufts. Respiratory trees two.

The species differs from *Ps. occultatus* only in the absence of spicules from respiratory trees and in the character of the deposits in perianal region.

*Habitat.*—Aleutian Islands.

*Type.*—Cat. No. 34147, U.S.N.M.

14. PSEUDOSTICHOPUS MOLPADIOIDES, new species.

Plate 8, figs. 6a-c.

Station 4982. Eight specimens.

Body cylindrical, not flattened, rapidly tapering at both extremities, measuring 52 mm. in length, 25 mm. in breadth, and 20 mm. in height. Mouth terminal but directed ventrad, anus lodged in a rather inconspicuous vertical furrow. Color dirty pale brown, surface being covered all over with sand and foraminiferan shells, while sponge needles are very few. Tentacles 20. Small pedicels also



present in interambulacra thinly scattered, those belonging to the midventral ambulacrum being almost indistinguishable from them. Larger pedicels, up to 2 mm. long, form a double row on each ventrolateral ambulacrum. In the dorsal ambulacra smaller papillæ (?) are arranged in double rows. No deposits are present in general perisome or genital tubes. In larger pedicels an end-plate  $140\mu$  in diameter is present, and near it a few supporting rods (pl. 8, figs. 6a, b),  $50\text{--}120\mu$  long, and always with a slight knob at the middle. Similar rods are found in tentacles, but these are much larger and are armed with short processes near the extremities. In the perianal region are found scattered irregular spiny bodies of varying complexity (fig. 6c),  $60\text{--}200\mu$  in length. The simplest ones are X-shaped. Calcareous ring well developed, radial segments having a pair of accessory processes near the outer edge of the anterior end. Polian vesicle single, genital tubes undivided, in two tufts. Respiratory trees two, well developed.

The present species agrees in many respects with *Ps. pustulosus* Sluiter, but differs from it above all in lacking the series of large stout warts along each side of ventrum.

*Habitat*.—Off Shiribeshi, Hokkaido.

*Type*.—Cat. No. 34148, U.S.N.M.

#### 15. PSEUDOSTICHOPUS ARENOSUS, new species.

Station 4915. One specimen.

Body more or less fusiform, 45 mm. long, 15 mm. broad. Mouth terminal but directing ventrad, anus situated in a vertical pygal furrow. Surface of body covered with numerous *Globigerina* shells and a few sponge needles, gray in color all over. Tentacles 20. There are conspicuous double rows of ambulacral appendages along paired ambulacra, of which the ventral ones have more crowded and larger pedicels, which may be as long as 1 mm. Along the odd ambulacrum no distinct row of pedicels can be found. Irregular spinous bodies similar to those in *Ps. molpadioides* and  $50\text{--}175\mu$  long are found scattered in perianal region. Pedicels have end-plates only, which measure up to  $90\mu$  in diameter. Supporting rods of tentacles bear numerous knobs. No deposits are found elsewhere. Calcareous ring well developed, radials being very thick. Polian vesicle single, genital tubes undivided. Respiratory trees two.

The present species very much resembles *Ps. molpadioides*, only differing in the absence of supporting rods in pedicels and in details of rods in tentacles.

*Habitat*.—Off Koshiki Islands, west of Kyushu.

*Type*.—Cat. No. 34149, U.S.N.M.

## 16. PSEUDOSTICHOPUS NUDUS, new species.

- Station 4768. Seven specimens.  
 Station 4769. One specimen.  
 Station 4771. Four specimens.  
 Station 4772. One specimen.  
 Station 4774. Five specimens.  
 Station 4775. Five specimens.  
 Station 4781. One specimen.  
 Station 4966. Five specimens.

Body subcylindrical, almost uniform breadth throughout, both extremities rounded. Length 190 mm., breadth 50 mm., and height 30 mm. Mouth ventral, anus in a conspicuous pygal furrow. Surface of body almost naked, sometimes coated with very few sponge needles. Color whitish, often light yellow or brownish. Tentacles 20. Numerous pedicels form a broad zone along the midventral ambulacrum, there being about 8 pedicels in a transverse line. Toward the posterior part of body there is a groove along the median line. The pedicels are very peculiar in shape, each consisting of a number of oval, knoblike parts, 0.3–0.5 mm., united into a group measuring 1–2 mm. in diameter. Along lateral margin of ventrum are very low processes, often invisible, probably in alternate rows. Dorsal papillæ, 1–1.5 mm. long, forming a double row along each ambulacrum, very sparse, separated by intervals of about 10 mm. Supporting rods of tentacles are curved, slightly spinous, often with irregular branches. Near tip of papillæ are found slender rods usually with a knoblike thickening at the middle, but often irregularly branched. No deposits whatever are found elsewhere. Calcareous ring is of the usual form, each segment often with a pair of minute teeth on the posterior margin. Polian vesicle single, respiratory trees two. Genital tubes undivided, arranged in a row along each side of dorsal mesentery.

Some strongly contracted specimens show along each side of body a low thickened ridge, "bourrelet epais," as in *Ps. depressus* Hérourard. *Ps. pustulosus* Sluiter differs from the present species in shape and arrangement of ambulacral appendages.

*Habitat*.—Aleutian Islands; off Kii, Honshu.

*Type*.—Cat. No. 34150, U.S.N.M.

## 17. PSEUDOSTICHOPUS UNGUICULATUS, new species.

Plate 8, figs. 7a–c.

- Station 4960. One specimen.  
 Station 5083. Two specimens.  
 Station 5084. One specimen.

Body 90 mm. long, 35 mm. broad, ventrum flat, dorsum strongly vaulted. Mouth directed ventrad, anus situated in a deep pygal

furrow. Integument thin and translucent, gray in color, closely covered with fine granules, chiefly foraminiferan shells. Tentacles black, 20 in number. The animal is characterized by 18–20 conical warts arranged along the sides of ventrum, with four or five curved papillæ at the tip, about 2 mm. long, with black tips. In each dorsal ambulacrum run two rows of short, slender papillæ, about 25 in number. Near the lateral margin of ventrum pedicels measuring 1 mm. in length form a very sparse row. Scattered irregularly along the odd ambulacrum are found very minute pedicels only 0.3 mm. long. Dorsal and lateral papillæ contain only a very small number of smooth supporting rods, 80–100  $\mu$  in length (pl. 8, fig. 7c). Pedicels of ventrolateral ambulacra have imperfect end-plates about 100  $\mu$  in diameter, but contain no supporting rod. Rods in tentacles are richly armed with spines. In genital tubes are scattered branching calcareous bodies, normally X-shaped, with a knob at the middle (fig. 7a, b), 80–200  $\mu$  in length. Calcareous ring is of the usual form, each segment often with minute teeth on the posterior margin. Polian vesicle single, respiratory trees two. Genital tubes unbranched, arranged in a row along each side of dorsal mesentery.

The present species is perhaps identical with *Meseres peripatus* Sluiter, which has rows of warts beset with 4–5 clawlike papillæ. But the presence of a distinct pygal furrow, of spicules in genital tubes, and other differences in deposits appear to distinguish *P. unguiculatus* from it and all other allied forms.

*Habitat.*—Southwest of Shikoku; south of Totomi, Honshu.

*Type.*—Cat. No. 34151, U.S.N.M.

#### Genus CAPHEIRA Ludwig.

##### 18. CAPHEIRA MOLLIS, new species.

Plate 9, figs. 16a, b.

Station 4767. One specimen.

Body elongated oval, rounded posteriorly. Length about 140 mm., width about 55 mm. Color dirty brown, tinged with yellow and green. Integument thin and finely wrinkled like crêpe, and highly delicate, apt to break even at a slight touch. Along ventrolateral ambulacra the body wall is slightly thickened. Tentacles 15, more or less shield-shaped, provided with 5 rounded digits. Very minute, pedicellike appendages, only 0.5–1 mm. long, are found scattered over the body except on midventral radius. Deposits of only one form, namely, triradiate tables, thickly overlapping one another. Disk with a small, round, central hole and oval peripheral ones, 6 to 12 in number (pl. 9, fig. 16a); diameter 107–220  $\mu$ , mean 160  $\mu$ . From the margin of the central hole arise three pillars, together making up a conical spire with always two crossbeams and a three-knobbed apex (fig. 16b). Height of spire varies 120–130  $\mu$ .

Calcareous ring consists of 15 saddle-shaped segments, each measuring 6 mm. by 4 mm., similar to those described in *C. sulcata* Ludwig. Polian vesicle single. Stone-canal calcified, ending in a knoblike madreporite attached to the body wall. Genital tubes branched many times, forming two tufts. I think I could make out a respiratory tree on the right side, though I can not be quite certain on this point, owing to the large mass of intestine which prevented more accurate observation.

From *C. sulcata* this species differs in shape and size of deposits and in number of tentacles. The genus resembles *Pseudostichopus* more than any of the forms of *Elasipoda*. Some aberrant forms of *Molpadiidæ* also show relationships with this genus.

*Habitat*.—Aleutian Islands.

*Type*.—Cat. No. 34152, U.S.N.M.

### Genus PÆLOPATIDES Théel.

#### 19. PÆLOPATIDES APPENDICULATA Théel.

*Pælopatides appendiculata* THÉEL, *Challenger* Holothurioidea, pt. 2, 1886, pp. 158-159.—MITSUKURI, *Actinopodous Holothurioidea*, 1912, pp. 9-10.

(?) *Pælopatides purpureo-punctatus* SLUITER, *Siboga* Holothurien, 1901, pp. 43-44.

Station 4971. One specimen.

Station 5053. Two specimens.

*Habitat*.—South of Totomi, Honshu (Théel, 1886); Flores and Sulu Sea (Sluiter, 1901); Suruga Bay (Mitsukuri, 1912); off Kii, Honshu.

#### 20. PÆLOPATIDES (?), species.

Station 5029. One specimen.

Station 5030. Two specimens and a fragment.

The largest specimen measures 90 mm. in length and the breadth is about 15 mm. throughout. Skin is totally scraped off, the transversely wrinkled muscle layer being exposed externally. Color of the anterior region including tentacles is grayish-purple, while the rest of body is yellowish-brown. Owing to maceration only 6 tentacles could be made out, and no trace of calcareous ring or deposits could be found. Musculature is well developed, each longitudinal muscle being 10 mm. wide and divided into two bands. Polian vesicle and stone-canal single. Though the whole digestive tube is wanting, its course seems to be normal, as judged from mesenteries left on the body wall. Genital organ rudimentary, respiratory trees 2, about 40 mm. long. The specimens are in too bad a condition for the pedicels and papillæ to be described.

*Habitat*.—Off Cape Terpeniya, Sakhalin; east of southern Sakhalin.

## Family DEIMATIDÆ Théel.

## Genus DEIMA Théel.

## 21. DEIMA MOSAICUM, new species.

Station 4956. Five specimens.

Station 5084. One specimen.

Body elongated oval, 110 mm. long and 40 mm. wide in largest specimen. Mouth and anus situated on ventral surface. Integument thin, very brittle, covered with thin scale-like plates all over, grayish-white in color. Mouth is situated at the center of a circular ridge, 20 mm. in diameter, with papillæ of microscopic size on outer margin. Tentacles 18, each provided with 7-10 digits. The odd ambulacrum is naked, except for a pair of small pedicels only 2 mm. long, situated immediately anterior to the anus. Pedicels of ventrolateral ambulacra, measuring up to 20 mm. in length and 6 mm. across, numbering from 11 to 13 arranged in a row to a side. "Flankenpapillen" are long and cylindrical, up to 80 mm. in length and 7 mm. in diameter at base, 4 or 5 to each row. Another set "eigentliche Rückenpapillen," form a row on either side of mid-dorsal line, numbering 8 to 10 in each. All over the body, including pedicels and papillæ, skin is strengthened with scale-like plates, partly overlapping one another. Those of ventrum measure 0.8-2.0 mm. in diameter, those of dorsum 3-4 mm. or more. They are round, with almost entire margin and numerous holes increasing in size toward the center, and rarely attaining the diameter of  $180\mu$ . Each scale of dorsum consists of two parallel layers of network, of which the upper one is destitute of spinous processes on its surface. Those of ventrum lack the upper layer, but a few tubercles are always found at the central part. The scales of pedicels and papillæ are similar to those of ventrum except that the margin is serrated. Around the mouth the plates are very simple and oval, with thorny surface and margin, 0.3-0.5 mm. in diameter, accompanied by delicate, branched rods or plates with a few holes. Pedicel is devoid of end-plate but is supported by rods of various forms, sometimes by perforated plates. Supporting rods of tentacles have spinose processes. Genital tubes contain in their walls very delicate, thread-like branched rods often congregated to form a complicated apparent anastomosis. Calcareous ring consists of 10 fragile segments. Stone-canal strengthened by network of deposits; Polian vesicle single. Genital tubes thick and few in number, forming two tufts.

While the specimens agree very well with *D. blakei* Théel in the structure of dorsal scales and the number of papillæ, they show many other details which are common with *D. pacificum* Ludwig. The

much larger size of dorsal scales, the slenderness and length of papillæ, and the number of tentacles seem to be peculiar to the new species.

*Habitat*.—Southwest of Shikoku; south of Totomi, Honshu.

*Type*.—Cat. No. 34153, U.S.N.M.

### Genus ORPHNURGUS Théel.

#### 22. ORPHNURGUS INSIGNIS Fisher.

*Orphnurgus insignis* FISHER, Hawaiian Holothurians, 1907, pp. 702-706, pl. 73, fig. 1; pl. 77, figs. 1, 1a-e, 2, 2a-c, 3, 3a-e.

Station 4957. One specimen.

Station 4958. Ten specimens.

Station 4960. One specimen.

The largest in the collection measures only 85 mm. in length, being much smaller than those from Hawaii. Fisher found the dorsal papillæ to be "arranged in a fairly regular linear series along each of the two dorsal radii," except in two specimens with "a double row." But in the Japanese specimens the presence of double rows seems to be constant, as may be seen from an examination of the ampullæ from inside the body wall. The inner (median) row consists of 15-27 papillæ of various sizes, while the outer (lateral) is composed of a very variable number of much smaller ones. In the largest specimen I could find 15 and 17 papillæ in the outer rows, while in smaller ones there were only 5-10, or even none, apparently. Besides the characteristic deposits as fully described and figured by Fisher, I find minute, complicated bodies in longitudinal muscles. These are sometimes rodlike, sometimes four-armed, and bear many branches on the ends and processes along the sides. The length varies 60-200 $\mu$ .

*Habitat*.—Hawaii (Fisher, 1907); southwest of Shikoku.

#### 23. ORPHNURGUS RIGIDUS, new species.

Station 4957. One specimen.

Station 4958. Two specimens.

Station 4959. Two specimens.

Station 5082. One specimen.

Body only 43 mm. long, of almost uniform breadth throughout, namely, 8 mm. Mouth ventral, with 20 nonretractile tentacles; anus terminal. Color grayish-white, tentacles light brown. Integument thin and stiff, armed with large rods, visible with naked eye. Pedicels nonretractile, 9 mm. long, 16-25, forming together a row along each side of ventrum. Very often, smaller ones alternate with the larger on the median side, so that a zigzag row is formed. The odd ventral ambulacrum is utterly devoid of pedicels. Above the lateral pedicels is a row of 13-17 flank papillæ on each side of body. Along each of the dorsal ambulaera papillæ are arranged in a double row, the inner consisting of 12-29, the outer of 6-17; a papilla may attain the length of 15 mm., and its base is conical and stiff, while

more distally it is soft and slender. Deposits in perisome are in the form of rods with both ends dilated and perforated, or rarely forked. Those of ventrum are robust, have more holes, and are more numerous than those of dorsum. Their length varies between 0.5 and 1.45 mm., often measuring 0.15 mm. across at the middle. In the posterior region they are more robust and short and very numerous. The rods of dorsum are slender, with a few terminal holes, length 0.4–1.25 mm., and even at the base of papillæ they are not of considerable length. These rods form groups of a few each, with their ends collected in a point. Very rarely some modified X-shaped rods are to be found in dorsum. The arms are not straight as in those of *Scotodeima setigerum* Ludwig, but always slightly curved. Diameter 240–430  $\mu$  as measured diagonally. Tentacles and pedicels are supported with larger straight rods and smaller bent ones, the former being 0.4–1.15 mm. long, and the latter only 0.2–0.6 mm.; end-plate is wanting. Supporting rods of papillæ are all straight; larger ones, 0.8–1.1 mm. long, gathered together in conical groups at base; smaller ones 0.25–0.6 mm. long, occurring sparsely in filamentous part. In genital tubes irregular branched rods, about 200  $\mu$  long, are sparsely present. Calcareous ring rather weakly developed, of spongy texture. Polian vesicle and stone-canal single. Genital tubes about five on each side of dorsal mesentery.

There are four species very much resembling the present species, all known by only one or two specimens each. These are *Scotodeima setigerum* Ludwig, *S. protectum* Sluiter, *S. vitreum* Fisher, and *Orphnurgus invalidus* Kœhler and Vaney. In the character of the deposits the present species stands between *O. invalidus* and *S. vitreum*, having several X-shaped bodies in dorsum. The presence or absence of a few small pedicels in the odd ambulacrum seems to be an unsafe guide in distinguishing genera, for Fisher has clearly shown the presence of 26 very small pedicels along that ambulacrum in *O. insignis*. It seems therefore likely to me that the genus *Scotodeima* should be merged into *Orphnurgus*.

*Habitat*.—Southwest of Shikoku; south of Totomi, Honshu.

*Type*.—Cat. No. 34154, U.S.N.M.

#### Genus PANNYCHIA Théel.

##### 24. PANNYCHIA MOSELEYI Théel.

*Pannychia moseleyi* THÉEL, *Challenger* Holothurioidea, pt. 1, 1882, pp. 88–90, pl. 17, figs. 1, 2; pl. 32, figs. 1–13.—MITSUKURI, *Actinopodous* Holothurioidea, 1912, pp. 207–212.

*Pannychia moseleyi*, var. *henrici* LUDWIG, *Albatross* Holothurioidea, 1894, pp. 95–99, pl. 10, figs. 1, 2.

Station 5085. One specimen.

*Habitat*.—Off Sydney and northwest of New Zealand (Théel, 1882); Moluccas (Sluiter, 1901); near Cocos Island (Ludwig, 1894); Lower

California (Ludwig, 1894; Clark, 1913); near Oshima Island (Kishinouye, 1894); Sagami Sea (Mitsukuri, 1912).

25. *PANNYCHIA MOSELEYI VIRGULIFERA*, new subspecies.

Plate 8, figs. 8a,b.

*Pannychia moseleyi* EDWARDS, *Albatross Holothurians*, 1907, pp. 62-64.

- Station 4768. Ten specimens.
- Station 4769. Seven specimens.
- Station 4770. Four specimens.
- Station 4771. One specimen.
- Station 4781. Six specimens.
- Station 5015. Two specimens.
- Station 5029. One specimen.
- Station 5032. Five specimens.
- Station 5033. One specimen.
- Station 5036. One specimen.
- Station 5039. Two specimens.

The largest specimen measures 210 mm. in length, 70 mm. in width, and 35 mm. in height. Color in life "pearly white with a bluish tint, papillæ reddish-purple;" in spirit some specimens almost retain their natural color, but others are white to light blue and rose, or brown. Ambulacral appendages purple in majority, but yellowish-brown in some. Tentacles 20. Pedicels of the ventrolateral ambulacra large, 25-40 in each. Along the midventral ambulacrum are 12-50 pedicels arranged in a zigzag or double row. Dorsal papillæ small, at most 3 mm. long, scattered all over, only leaving in some specimens narrow naked areas along the 3 interambulacra. Along the inner (median) side of dorsal ambulacra stand about 8 pairs of long whiplike papillæ, attaining the length of 20 mm. All the external and internal characters are those of *P. moseleyi*, but numerous "straight or arcuated, simple or branched, spinous" bodies (pl. 8, fig. 8a) occur in large numbers in all the specimens, uniformly scattered on ventrum. In some specimens they are highly spinous at ends, in others quite smooth (fig. 8b), and in rare cases three- or four-rayed. Length of these rods varies from 70 to 400  $\mu$ , with a mean of about 240  $\mu$ . Similar rods are also numerous in walls of pedicels.

The specimens above described differ from those of *P. moseleyi* only in having numerous rods in ventrum. In *P. moseleyi* the rods are never present in ventral perisome, but occur in small numbers in pedicels. I think that the specimens before me, together with a single specimen identified as *P. moseleyi* by Edwards, are to be distinguished as a northern form of that widespread species and deserve recognition as a subspecies.

*Habitat*.—Sitka, British Columbia (Edwards, 1907); Aleutian Islands; off Cape Terpyeniya, Sakhalin; east of southern Sakhalin; east and south of Hokkaido.

*Type*.—Cat. No. 34155, U.S.N.M.



## Genus LÆTMOGONE Théel.

## 26. LÆTMOGONE VIOLACEA Théel.

*Lætmogone violacea* THÉEL, Bihang til kongl. Sv. Vet. Akad. Handl., vol. 5, 1879, p. 11; *Challenger* Holothurioidea, pt. 1, 1882, pp. 78-80, pl. 13, figs. 1-3; pl. 36, figs. 20-24; pl. 42, fig. 2.—PERRIER, *Travailleur* and *Talisman* Holothurioidea, 1902, pp. 390-398, pl. 19, figs. 1-7.—AUGUSTIN, *Japanische Seewalzen*, 1908, p. 21.—MITSUKURI, *Actinopodous Holothurioidea*, 1912, pp. 192-198, pl. 6, figs. 52-54, text-fig. 36.

*Cryodora spongiosa* THÉEL, Bihang til kongl. Sv. Vet. Akad. Handl., vol. 5, 1879, p. 9.

*Lætmogone spongiosa* THÉEL, *Challenger* Holothurioidea, pt. 1, 1882, pp. 80-82, pl. 14, figs. 1-3; pl. 39, figs. 5-6.

*Lætmogone jourdaini* PETIT, Bull. Soc. Philomat., Paris, ser. 7, vol. 9, 1885, pp. 9-11.

*Lætmogone brongniarti* E. PERRIER, *Les Explorations sousmarines*, 1886, fig. 241.

Station 4919. One specimen.

Station 4957. One specimen.

Station 4958. One specimen.

Station 4960. One specimen.

Station 5082. Two specimens.

Station 5088. One specimen.

The specimens from Station 5082 are the largest ever recorded, being 170 mm. long and 45 mm. in breadth.

*Habitat*.—Off Sydney (Théel, 1879); Flores Sea and Moluccas (Sluiter, 1901); Andaman Islands (Walsh, 1891); Maldives (Køehler and Vaney, 1905); west Greenland (Mortensen, 1913); north of Scotland (Théel, 1882); Bay of Biscay (Petit, 1885); from off Gibraltar along the west coast of Morocco and Sahara to Senegal, and Azores (Perrier, 1902); south of Totomi, Houshu (Théel, 1879); Sagami Sea (Mitsukuri, 1912); off Koshiki Islands, west of Kyushu; southwest of Shikoku.

## 27. LÆTMOGONE PARVA Mitsukuri.

*Lætmogone parva* MITSUKURI, *Actinopodous Holothurioidea*, 1912, pp. 186-188, pl. 5, figs. 46-47, text-fig. 34.

Station 4956. One specimen.

The specimen is much larger than the original ones, measuring 68 mm. in length, 12 mm. in width, and 10 mm. in height. Integument is thick and gelatinous, of a gray color all over. At bases of tentacles and papillæ deep purple patches are to be seen. Tentacles 15, nonretractile. Papillæ retracted, about 20 in a row along the median side of each dorsal ambulacrum. Pedicels also retractile, quite minute, probably about 30 in each row along lateral margin of ventrum. Unlike the original specimens, the present one contains small, wheel-like plates scattered all over the dorsal perisome. They are precisely the same as those described by Mitsukuri, with a mean diameter of  $76\mu$ , and varying between  $60-117\mu$ . Peripheral holes are almost constantly 10 in number, but may in exceptional

cases increase to 11 or 12. The wheels in papillæ are smaller than those of perisome, measuring about  $45\mu$ . Pedicels contain numerous, well developed, bent, spinose rods and an end-plate. Ventral perisome is totally devoid of deposits. Genital tubes have also no deposits, each branched once or twice dichotomously near its base, and forming two tufts. Calcareous ring absent, represented by a connective tissue. Polian vesicle single and small. Other characters agree well with the original specimens.

Though differing in the number of papillæ and in distribution of deposits there is scarcely any doubt that the specimen belongs to the present species. The differences may be due to the age of the animal.

*Habitat.*—Several stations in Uraga Channel (Mitsukuri, 1912); southwest of Shikoku.

28. *LÆTMOGONE SELENKAI* Mitsukuri.

*Lætmogone selenkai* MITSUKURI, Actinopodous Holothurioidea, 1912, pp. 189-192, pl. 5, figs. 48-51, text-fig. 35.

Station 4903. One specimen.

Station 4904. Six specimens.

The largest specimen is only 40 mm. long. The specimens differ from the original (first) in the size of the dorsal papillæ, which measure only 0.5-0.7 mm. in length and are much smaller than pedicels, which measure 3-4 mm. in length, and (secondly) in the size of the large wheels, which measure 80-280 $\mu$  in diameter, thus attaining more than twice the size given for the original specimens. It may also be noticed that small wheellike plates are richly developed in radial muscles, and that delicate branching rods 180-320 $\mu$  long are present in genital tubes.

*L. neglecta* Mitsukuri much resembles the present species, but differs in the number of spokes in the large wheels and in having rods in ventrum.

*Habitat.*—Uraga Channel (Mitsukuri, 1912); off Goto Islands, west of Kyushu.

Genus *ILYODÆMON* Théel.

29. *ILYODÆMON IJIMAI* Mitsukuri.

*Ilyodæmon ijimai* MITSUKURI, Annot. Zool. Japon., vol. 1, pt. 4, 1897, pp. 133-135; Actinopodous Holothurioidea, 1912, pp. 200-207, pl. 6, fig. 55, text-fig. 37.  
*Benthogone quatrolineata* AUGUSTIN (not Perrier), Japanische Seewalzen, 1908, pp. 21-23, fig. 15.

Station 4968. One specimen.

Station 5088. Fifteen specimens.

Station 5090. One specimen.

Station 5092. Two specimens.

The largest specimen measures 105 mm. in length and about 30 mm. in breadth. Of the 4 rows of dorsal papillæ the inner (median) series

have a few more papillæ than the outer (lateral), the former consisting of 57–65 papillæ, and the latter of only 52–60 in each. Besides the deposits hitherto known, slender spinose rods occur in walls of genital tubes, and small wheellike plates are abundantly found in longitudinal muscles.

It is scarcely to be doubted that Augustin had before him a specimen of this species. His figure of the wheel was probably drawn from an incompletely developed one, in which the felly had not attained its full thickness.

*Habitat*.—Numerous stations in Sagami Sea (Mitsukuri, 1912); entrance of Tokyo Bay (Augustin, 1908); off Kii, Hōnshū.

30. *ILYODÆMON MIURENSE*, new species.

Plate 8, figs. 9a-c.

Station 5094. Five specimens.

Body very much like that of *I. ijimai* in external features, the largest specimen is 75 mm. long, 22 mm. broad; length therefore 2.5–3 times the breadth. Mouth ventral, surrounded with 15 almost uniform-sized tentacles; anus terminal. Color gray, dorsal papillæ violet. Lateral pedicels in a single series, 20 in each, largest ones 8 mm. long and 4 mm. across at base, diminishing in size backward. Papillæ form two rows along each dorsal ambulacrum, as long as the lateral pedicels but only half as thick. The inner (median) series consists of 33–36 papillæ, while the outer (lateral) one always contains fewer papillæ, viz, 20–26. Deposits of general perisome in 3 kinds—large wheels, small wheellike plates, and complicated rosettes. Large wheels (pl. 8, fig. 9a) are most numerous in ventrum, pedicels, and tentacles, less numerous in dorsum. Spokes most commonly 9, but may rarely vary from 7 to 12. Central holes are 6 in most cases, but may vary from 4 to 8. Of these 6, three are alternately larger and small, and over the larger ones there is a triradiate body which grows out from the “Mittelpfeiler” as in *I. maculatus* Théel.<sup>1</sup> In perisome diameter of these wheels varies between 160 and 260 $\mu$ , with a mean of 220 $\mu$ , while in pedicels and papillæ they are often as small as 60–80 $\mu$ . Small wheellike plates (fig. 9b) are as usual oval in outline, with 4 central and 12 peripheral holes. They are abundantly found in pedicels, papillæ, tips of tentacles, peristomial region, and radial muscles. Mean diameter 30 $\mu$ , range 24–45 $\mu$ . Complicated rosettes (fig. 9c) are found mingled with the small wheellike plates, and are nearly the same size as the latter. Tentacles and pedicels have bent spinous rods, often branched; papillæ destitute of them. Delicate, almost smooth, often branched, rods are found in peristomial region.

<sup>1</sup> Théel, 1882, pl. 36, fig. 15.

No deposits in genital tubes. Calcareous ring is of the common shape, Polian vesicle single. Genital tubes branched many times, forming two tufts, and opening on a papilla; near it also opens the stone-canal.

This species differs from *I. ijimai* in, first, the smaller number of dorsal papillæ, second, the presence of complicated rosettes, and third, absence of spicules from genital tubes. *I. maculatus* has the large wheels and complicated rosettes similar to those of the present species, but the dorsal papillæ are much more numerous, there being 140-150 in each ambulacrum.

*Habitat.*—Off Jogashima, Miura Peninsula, Sagami.

*Type.*—Cat. No. 34156, U.S.N.M.

### Family ELPIDIIDÆ Théel.

### Genus PENIAGONE Théel.

#### 31. PENIAGONE JAPONICA, new species.

Plate 9, fig. 10.

Station 4974. Three specimens.

Station 5083. One specimen.

Station 5084. Seven specimens.

The anterior end of body is bent ventrad, and in its center opens the mouth. On the dorsal side of the necklike region there is a transverse series of four papillæ, 10-14 mm. long, connected together at bases by a weblike fold; two more pairs of minute papillæ immediately behind. Along each side of body a lateral brim separates the ventral from the dorsal surface. Length of body 55 mm., width about one-third the length. Color pale white all over. Integument thin and soft, slightly rough to the touch. Tentacles large, probably 10; only 6 could be made out owing to bad preservation. About 8 pedicels form a single row along each side of the posterior half of body, beneath the lateral brim. The anteriormost ones are largest, measuring about 4 mm. in length. Deposits in dorsum are of two kinds, lying in distinct layers. The superficial ones are of the common shape, consisting of a short central rod and 4 bent thorny arms, each with a shorter vertical process near the base. The arms are 120-200 $\mu$  long, the vertical processes 70-120  $\mu$ . The deeper layer consists of scattered, large X-shaped bodies (pl. 9, fig. 10). The arms are straight, bear minute teeth near the free end, and measure 140-520 $\mu$  in length, sometimes much shorter, being only 60 $\mu$ . The central rod is less variable in length, commonly 50 $\mu$ , but ranging between 40 and 80 $\mu$ . In ventrum, pedicels, and stalks of tentacles are found only those corresponding to the superficial ones of dorsum. The arms are but slightly bent downward, measuring 90-140 $\mu$  long, with vertical processes 20-50 $\mu$  long. Papillæ and tips of tentacles are beset with

curved, spiny rods often branched, sometimes X-shaped. Very rarely, simple, spiny, unbranched rods are found besides the four-rayed spicules. In genital tubes are found slender X-shaped bodies like those known in *P. intermedia* Ludwig. Their arms measure 100–340 $\mu$ . Calcareous ring consists of 5 radial segments only, 1 mm. in length, with numerous, branched projections. Stone-canal rather large, not specially strengthened with spicules, opens externally about midway between tentacular crown and dorsal brim. Polian vesicle single. Radial muscles well developed, dorsal pair divided, others simple, midventral one being much more slender. Genital tubes borne on two large branches of the wide duct, which opens near the madreporic aperture.

*P. azorica* v. Marenzeller and *P. purpurea* (Théel) are very close to the present species but differ above all in the absence of the lateral brims. *P. atrox* Théel, *P. expansa* Kœhler and Vaney, and *P. intermedia* Ludwig have lateral brims, but differ in shape of spicules.

I refer the specimen from station 5083 to this species with much doubt. Spicules of this specimen are asymmetrical in having only three vertical processes. Probably this may be a different and unrecorded species.

*Habitat*.—Off Kii, Honshu; south of Totomi, Honshu.

*Type*.—Cat. No. 34157, U.S.N.M.

#### Genus ACHLYONICE Théel.

##### 32. ACHLYONICE MONACTINICA, new species.

Plate 9, figs. 11a-c.

Station 4974. One specimen.

Station 5084. Sixteen specimens.

Body elongated, length 100 mm., about 3.5–4 times the width. Anterior end strongly bent ventrad, mouth terminal but ventral, anus slightly turned dorsad. Dorsum much vaulted, but flattened at the posterior part. Color uniformly pale white, integument opaque, smooth to the touch. Tentacles 12, nonretractile, connected with one another by a membranous fold of skin, except the smaller 4 of the ventral side, which are free. Tips of tentacles light yellow. On the dorsal side of the necklike part there is a transverse fold of skin with two pairs of papillæ. The papillæ of the anterior (median) pair are short and project but little from the skin fold as a very short conical process, while the second pair, which are posterolateral to the former, are 15 mm. in their free parts. There are two more pairs of minute papillæ behind the large ones just mentioned. Pedicels confined to the posterior half of body, in a row along each side of ventrum, 10–13 in each row, most commonly 11. The anteriormost are largest, 7.5 mm. long and 4 mm. across. The only deposits are slender, unbranched rods with some spines (pl. 9, fig. 11c); though very rarely

there may be a branch (figs. 11a, b), never symmetrically triradiate. They are very sparsely scattered in general perisome, tentacles, pedicels, radial muscles, peritoneum, and genital organ. In general perisome they vary in length between 100 and 280 $\mu$ , but are most commonly 150–170 $\mu$ . In dorsum they are more sparse and slender. In tentacles, papillæ, and pedicels the rods are of a similar shape, but larger, 200–300 $\mu$ , and more numerous. No end-plate in pedicels. Spicules in genital tubes and duct are numerous, delicate, usually branched, and spinose (fig. 11a), 120–240 $\mu$  in length. The walls of intestine, cloaca, and stone-canal are destitute of deposits. Calcareous ring consists of 5 radials only, which have 6 pairs of simple or only bifurcated processes. Stone-canal minute, meandering in course, opening midway between anterior end and dorsal skin fold. Polian vesicle single. Genital tubes short, once or twice branched, forming some 15 tufts attached to a long, wide genital duct, measuring over 100 mm. in length and 5 mm. in diameter. Mesentery represented by a number of ribbonlike filaments, 1–1.5 mm. in width. Cloaca provided with an inconspicuous cœcum. Radial muscles thick, dorsal pair 9 mm. wide and divided, the others not. The mid-ventral one is markedly slender in the anterior half.

From the two hitherto known species of the genus, *A. ealcareia* (Théel) and *A. lactea* Théel, the present species differs in having no symmetrical triradiate deposits.

*Habitat*.—Off Kii; south of Totomi, Honshu.

*Type*.—Cat. No. 34158, U.S.N.M.

### Genus SCOTOPLANES Théel.

#### 33. SCOTOPLANES THÉELI, new species.

Station 5032. Six specimens.

Station 5033. Three specimens.

Body ovate, posterior half broader than the anterior. Length 80 mm., width 30 mm., the latter never exceeding one-half of the former. Dorsum vaulted, ventrum flat, mouth and anus terminal but directed ventrad. Color light brownish-gray all over; integument very thin and soft. Tentacles 10, terminal disk with 10 marginal digits and a number of knob-like processes in the central part. Pedicels 7, rarely 6, forming a row along the whole length on each side of ventrum; they decrease in size from the anteriormost ones, which measure 15 mm. long and 7 mm. across at base, backward, the last one being often quite rudimentary. Dorsal papillæ invariably in 3 pairs, the first being situated at about the middle of the anterior half of body, the second, at the middle of body or more commonly a little more anteriorly. Both these pairs are long, measuring 23 mm., and 4 mm. across at base. The third pair stand immediately behind the second but are slightly more lateral in position,

and measure about 8 mm. in length. Numerous C-shaped deposits are found in general perisome, tentacles, papillæ, pedicels, and genital organ, and very rarely in peritoneum, but never present in intestine. Diameter of these deposits measures 45–130 $\mu$ , most commonly 80–100 $\mu$ . Mingled with these but less numerous are straight or curved, unbranched and spinose rods, 140–880 $\mu$  long, most commonly 400–600 $\mu$ . No other kind of deposits is found. Calcareous ring made up of five radials only, which have four pairs of branching processes. Stone-canal opens about 10 mm. behind the tentacular crown. Polian vesicle single. Intestine connected to body-wall by means of numerous filaments, instead of mesentery; cloaca globular but without cœcal appendage.

There is a remarkable agreement in every character between the present species and *S. globosa* Théel. The two forms differ from each other only, first, in relative width of body to length; second, in position of the second and third pairs of papillæ; and, third, in development of cœcal appendage. The species may therefore better be separated, and is named in honor of Prof. J. Hjalmar Théel, of the Naturhistoriska Riks-Museum, Stockholm, for his splendid work on the deep-sea holothurians.

*Habitat*.—Nemuro Strait, east end of Hokkaido.

*Type*.—Cat. No. 34159, U.S.N.M.

#### Genus ENYPNIASTES Théel.

##### 34. ENYPNIASTES EXIMIA Théel.

*Enypniastes eximia* THEEL, *Challenger* Holothurioidea, pt. 1, 1882, pp. 56–57, pl. 8, figs. 6, 7.—SLUITER, *Siboga* Holothurien, 1901, pp. 77–79, pl. 2, figs. 8, 9; pl. 10, fig. 5.—MITSUKURI, *Actinopodous* Holothurioidea, 1912, pp. 215–218, pl. 7, figs. 59, 60.

Station 4906. Nine specimens.

Station 4907. Twelve specimens.

Station 4914. Two specimens.

Body up to 90 mm. in length. In a specimen preserved in formalin, color is totally gone. One can clearly make out 12 papillæ forming together a large brim, median genital papilla, 3 pairs of dorsal papillæ, and 8 pairs of pedicels rather crowded near the posterior end of body. In all the other specimens, which are preserved in alcohol, the ground color is reddish-violet, which is specially intense on pedicels and papillæ, and replaced by dark brown in tentacles. The most striking fact is that the ovarian ova are of considerable size, exceeding all records for holothurians, being 3–3.5 mm. in diameter.

As it is difficult in such highly delicate animals to make out in preserved specimens the real disposition of appendages, it is rather doubtful to me whether the genus *Euriplastes* Kœhler and Vaney can really be kept separate from *Enypniastes*.

*Habitat*.—New Zealand (Théel, 1882); Moluccas (Sluiter, 1901); northern parts of Suruga Bay, Japan (Mitsukuri, 1912); off Koshiki Islands, west of Kyushu.

Family PSYCHROPOTIDÆ Théel.

Genus PSYCHROPOTES Théel.

35. PSYCHROPOTES RARIPES Ludwig.

*Psychropotes raripes* LUDWIG, Bull. Mus. Comp. Zool., Harvard Coll., vol. 24, No. 4, 1893, pp. 107-108; *Albatross* Holothurioidea, 1894, pp. 48-51, pl. 5, figs. 1-16.

Station 5030. Five specimens.

The largest specimen in formalin measures 195 mm. in length of body proper, 75 mm. in length of tail, 45 mm. in width of body. Minute dorsal papillæ 4-8 in each row. Pedicels of the lateral margin of sole up to 9 on each side, but usually 7. Those of the odd ambulacrum in 15-20 pairs, most commonly 18 or 19. The anterior brim contains 28 pedicels, in one exceptional case only 25. Other characters are in full agreement with the original description of Ludwig. Deposits almost entirely dissolved in all the specimens, only leaving some traces.

*Habitat*.—Gulf of Panama (Ludwig, 1893); east of southern Sakhalin.

Genus EUPHRONIDES Théel.

36. EUPHRONIDES DEPRESSA Théel.

*Euphronides depressa* THÉEL (part), *Challenger* Holothurioidea, pt. 1, 1882, pp. 93-96, pl. 26, figs. 1, 2.<sup>1</sup>—PERRIER, *Travailleur* and *Talisman* Holothurioidea, 1902, p. 434.

*Euphronides tanneri* LUDWIG, Bull. Mus. Comp. Zool., Harvard Coll., vol. 24, No. 4, 1893, p. 107; *Albatross* Holothurioidea, 1894, pp. 39-44, pl. 3, fig. 7; pl. 4, figs. 17-19.

Station 5084. Twenty-three specimens.

Length of body up to 210 mm., breadth 85 mm. Pedicels of the odd ambulacrum about 35 pairs, varying 25-40. Lateral brim with about 45 pedicels. Dorsal papillæ in most cases 4 or 5 to each side, but sometimes 6, posterior ones very often of considerable size. In one individual the posteriormost one is 20 mm. long and 10 mm. in diameter at base, in others quite small, being only 5 mm. long and 2.5 mm. across. The large unpaired papilla is also very variable in size as well as in shape. It may be 40 mm. long and 25 mm. broad. In only 3 of the 23 specimens is this papilla single-pointed (text-fig. D); in another the bifurcation is only slightly indicated at tip (fig. C);

<sup>1</sup> The spicules represented in figs. 5 and 6, pl. 35, are those of an Atlantic specimen which is referred by Perrier to *E. auriculata*.



in all the others it is divided in varying degrees at tip (fig. B), and in one extreme case the division is carried half way down the whole length of the papilla (fig. A). Ovarian ova 2.5 mm. in diameter. Deposits are exactly the same as those described and figured by Ludwig for his *E. tanneri*, except that I could not find any stunted bodies in genital organ.

Ludwig's specimen seems to belong to the same species as the two original specimens of Théel, secured from off the coast of Chile and rather imperfectly reported. Since the size and shape of dorsal papillæ are very variable, I am convinced that the Atlantic forms, *E. cornuta* Verrill, *E. depressa*, var. *minor* Théel, *E. auriculata* Perrier,

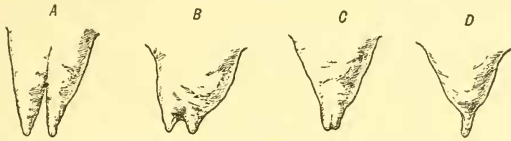


FIG. 1.—EUPHRONIDES DEPRESSA. DORSAL UNPAIRED PAPILLA FROM VARIOUS INDIVIDUALS, SHOWING VARIATION IN DEGREE OF BIFURCATION.  $\times 1$ .

*E. violacea* Perrier, and *E. talismani* Perrier are identical with one another.

*Habitat*.—Off the coast of Chile (Théel, 1882); north of Cape San Francisco (Ludwig, 1893); south of Totomi, Honshu.

### Genus BENTHODYTES Théel.

#### 37. BENTHODYTES SANGUINOLENTA Théel.

*Benthodytes sanguinolenta* THÉEL, *Challenger* Holothurioidea, pt. 1, 1882, pp. 104-105, pl. 23; pl. 40, figs. 4, 5; pl. 42, fig. 6.—LUDWIG, *Albatross* Holothurioidea, 1894, pp. 53-60, pl. 1, figs. 1-8.

Station 4971. Four specimens.

Station 4972. One specimen.

Station 4973. Five specimens.

To the excellent description given by Ludwig a few additions may be made. Sparsely scattered rods are found not only in walls of tentacles and genital tubes but also in the intestinal blood vessels. These deposits are similar in shape to those in other parts, measuring 150-250 $\mu$  in length. In the largest specimen, 210 mm. long, the cœcal appendage of cloaca measured 40 mm. long and 6 mm. across, with its apex divided into two branches about 5 mm. long. The large ovarian ova measure 2.2 mm. in diameter, as stated by Ludwig.

*Habitat*.—Off the coast of Chile (Théel, 1882); Panamic region (Ludwig, 1894); Lower California (Clark, 1913); Bengal Bay (Walsh, 1891); Laccadives and Andaman Islands (Kœhler and Vaney, 1905); off Kii, Honshu, Japan.

## 38. BENTHODYTES GOTOI, new species.

Plate 9, fig. 12.

Station 5030. Four specimens.

Body rather long, 195 mm., with the uniform breadth of about 35 mm. throughout. Ventrums flat, dorsum strongly vaulted, probably exaggerated by contraction. Mouth ventral, anus dorsal. Color of the anterior region, tentacles, and pedicels dark violet, other parts light violet-gray. Integument thin and soft, smooth to the touch. Only the apices of dorsal papillæ are very rough, spines of deposits, perceptible with naked eye, protruding through epidermis. Tentacles 15, more or less retractile. Pedicels of the odd ambulacrum retractile and minute, 50 or more in number, arranged in a zigzag row, none in the anterior region. Those forming the lateral brim number more than 50 to a side. Papillæ in a single row along each dorsal ambulacrum, of two different sizes. In each row there are 5-8 large conical papillæ with rounded ends, up to 12 mm. long and 8 mm. across, and 1-5 filiform ones, only 2 mm. long, confined to the anterior region. Some of these filiform ones are very often situated on the wall of a larger papilla. The total number of the papillæ of these two sorts is usually 9 or 10, in one case up to 14, to a side. Deposits in general perisome of dorsum are spinose cruciform bodies with an anchor-shaped spire (pl. 9, fig. 12), reminding one of the spicules of *Euphronides anchora* Hérouard. The arms are arcuated and spinous, measuring together with its fellow of the opposite side 200-360 $\mu$  in length. The spire is 100-130 $\mu$  long, with a pair of arched arms provided with 3-4 pairs of minute teeth along their concave side, and a few more minute ones near the apex. The span length of the anchor arms measures about 100 $\mu$ . These spicules are extremely scanty, only one or two in each 50 square mm. of area, and even in the anterior brim, where they are more numerous, only 10 spicules are found in the same extent of area. On tips of large papillæ are found gigantic spicules exactly of the same form as those described by Sluiter in his *B. hystrix*.<sup>1</sup> In these the length of an arm measures 0.3-0.8 mm., and may reach 1 mm.; central spire 250-550 $\mu$  long usually bifurcated for one-half of its length. Some small anchor-bearing spicules similar to those of perisome are also found at tips of large papillæ. The smaller papillæ have small spinose, cruciform spicules or simple unbranched rods, all with spinose arms but lacking a central spire. In ventrum are found very rarely, unbranched spinose rods measuring 250-550 $\mu$  in length. Supporting rods of tentacles, up to 1 mm. long, with a few spines at both ends. Egg follicles and genital duct with thinly scattered, delicate, cruciform spicules in the walls, one of the pairs of arms being very often shorter than the other; length of spicules 270-480 $\mu$ . No deposits in walls of intestine.

<sup>1</sup> *Siboga* Holothurien, 1901, pl. 9, fig. 10a.

Polian vesicle and stone-canal single. The female genital organ consists of a large duct on each side, and a dozen or more follicles attached to each of them. Ova are large, 2.5 mm. or more in diameter.

*B. hystrix* is very closely allied to the present species, differing only in having the dorsal perisome "rauh durch die hervortretenden Nadeln der Kalkkörperchen," which are visible to naked eye. From it and other allied species, *B. lingua* Perrier, *B. janthina* v. Marenzeller, and *B. sordida* Théel, my species differs above all in having characteristic anchor-bearing spicules. The species is named for Prof. Seitaro Goto of the Tokyo Imperial University.

*Habitat*.—East of Southern Sakhalin.

*Type*.—Cat. No. 34160, U.S.N.M.

### Family HOLOTHURIIDÆ Ludwig.

#### Genus HOLOTHURIA Linnæus.

##### 39. HOLOTHURIA MONACARIA (Lesson).

*Psolus monacaria* LESSON, Centurie zoologique, 1830, p. 225, pl. 78.

*Holothuria monacaria* JÆGER, De Holothuriis, 1883, p. 24.

*Holothuria decorata* v. MARENZELLER, Neue Holothurien von Japan und China, 1881, pp. 137-139, pl. 5, fig. 12.

Station 4937. One specimen.

Station 4946. One specimen.

*Habitat in Japan*<sup>1</sup>.—Japan (Théel, 1886); Enoshima (v. Marenzeller, 1881); Okinose, Sagami Sea (Clark, 1908); Doketsuba, Sagami Sea; Misaki; Kominato, Boshu; Hommura, Awaji; Oita and Sag-anoseki, Kyushu; Iki Island (Mitsukuri, 1912); Nagasaki (Britten, 1907); Kagoshima Bay.

### Family STICHOPIDÆ Östergren.

#### Genus STICHOPUS Brandt.

##### 40. STICHOPUS JAPONICUS Selenka.

*Stichopus japonicus* SELENKA, Beiträge zur Anatomie und Systematik der Holothurien, 1867, p. 318, pl. 18, figs. 33-36.—MITSUKURI, Annot. Zool. Japon., vol. 1, pts. 1-2, 1897, pp. 31-42; Actinopodous Holothurioidea, 1912, pp. 163-171, pl. 4, figs. 32-44, text-fig. 29.

*Holothuria armata* SELENKA, Beiträge zur Anatomie und Systematik der Holothurien, 1867, p. 330, pl. 18, fig. 66.

*Stichopus japonicus*, var. *typicus* THÉEL, Challenger Holothurioidea, pt. 2, 1886, pp. 161-162, pl. 8, fig. 2.

*Stichopus armatus* AUGUSTIN, Japanische Seewalzen, 1908, pp. 10-11.

*Stichopus roseus* AUGUSTIN, Japanische Seewalzen, 1908, pp. 13-14, text-fig. 10.

Tsuruga. One specimen.

The specimen is much contracted, only 95 mm. long, in the typical "III. stage" of development according to Mitsukuri's terminology. Deposits are of three kinds; first, complete tables with round disk and

<sup>1</sup> For other localities see Mitsukuri, Actinopodous Holothurioidea, 1912, pp. 117-118.

high spire; second, somewhat smaller tables with serrated disk and imperfect spire; and third, four-holed buttons without spire. Of these three kinds the last named are most abundant.

Augustin seems to have had before him specimens of various stages of development. His *S. roseus* is based on young specimens of this common species.

*Habitat*.—Amboina? (Lampert, 1885); Hongkong (Théel, 1886); Sitka (Clark, 1902); Hakodate (Selenka, 1867); Yokohama (Ludwig, 1887); Jogashima and Aburatsubo, Misaki (Augustin, 1908); southern Sakhalin and east coast of Korea (Britten, 1908); numerous localities on the coasts of Japan, from the Kuriles to Kagoshima, the southernmost part of Kyūshū, including Sakhalin and east coast of Korea to Vladivostok (Mitsukuri, 1912).

41. *STICHOPUS NIGRIPUNCTATUS* Augustin.

Plate 9, figs. 13a, b.

*Stichopus nigripunctatus* AUGUSTIN, *Japanische Seewalzen*, 1908, pp. 7-8, pl. 1, fig. 2, text-fig. 5.

*Stichopus depressus* AUGUSTIN, *Japanische Seewalzen*, 1908, pp. 11-13, pl. 1, fig. 4, text-figs. 8-9.

*Stichopus oustoni* MITSUKURI, *Actinopodous Holothurioidea*, 1912, pp. 175-178, pl. 2, figs. 18-20, text-fig. 31.

Station 4940. One specimen.

Station 4941. Two specimens.

Station 5046. One specimen.

Station 5092. Six specimens.

Station 5094. Three specimens.

No label. One specimen.

The largest specimen measures 260 mm. long, 60 mm. broad, and 50 mm. in thickness. Some of the specimens from station 5092 are quite young, the smallest being only 27 mm. long. Number of lateral papillæ varies 17-27 on each side, but is much reduced in young ones. In the smallest specimen there are only 12 lateral papillæ, and on each dorsal ambulacrum about 10 papillæ of similar size are arranged in a zigzag row. Distribution of pedicels agrees well with the statements of preceding authors. In the youngest specimen, however, pedicels are in a double row in midventral ambulacrum, and in a single row in each ventrolateral ambulacrum, alternating with the lateral papillæ.

A noteworthy fact in this species is the change which the calcareous deposits undergo during the growth of the animal. In the youngest specimen above mentioned, the deposits of the body wall as well as of the pedicels and papillæ are all well developed tables (pl. 9, figs. 13a, b). The disk is large and round, with entire margin, 60-135 $\mu$  in diameter. The spire consists of 4 pillars, connected with each other by 3 or 4 crossbeams, 50-65 $\mu$  in height. In an advanced stage, represented by a specimen 70 mm. long, there are found two sorts of tables,

between which various intermediate forms are to be found. One sort is similar in shape to those found in the foregoing stage, and generally lie in a deeper part. The other is of the same form as those found in larger specimens, and these are more numerous than the large round tables. In specimens of a still more advanced stage, about 130–150 mm. long, the round tables are very rarely found between those of another form. In full-grown specimens there is only one kind of table, the second sort, with small serrated disk and plump spire, as figured by previous authors (Augustin, text-figs. 5, 8; Mitsukuri, text-figs. 31*b*, *c*). The margin of the disks varies in the degree of its serration in different individuals (compare with *S. depressus*). In rare cases the spire is totally absent, the deposit thus becoming a mere perforated plate. Diameter of disks of these tables varies 46–106 $\mu$ , height of spire, 40–60 $\mu$ .

*Habitat*.—Numerous stations in Sagami Sea (Augustin, 1908; Mitsukuri, 1912); Ibaraki Prefecture; Aomori Prefecture; Provinces Noto and Ettchu (Mitsukuri, 1912); Kagoshima Bay; off Ojika Peninsula.

### Family MOLPADIIDÆ J. Müller.

#### Genus MOLPADIA Cuvier.

##### 42. MOLPADIA RORETZII (v. Marenzeller).

*Haplodactyla roretzii* v. MARENZELLER, Denkschr. d. k. Akad. d. Wiss., vol. 35, 1877, p. 387, pl. 4, fig. 1.

*Ankyroderma roretzii* v. MARENZELLER, Neue Holothurien von Japan und China, 1881, pp. 124–126, pl. 4, fig. 4.—MITSUKURI, Actinopodous Holothurioidea, 1912, pp. 267–275, pl. 8, fig. 78, text-fig. 55.

*Ankyroderma simile* THÉEL, Challenger Holothurioidea, pt. 2, 1886, pp. 40–41, pl. 2, fig. 5; pl. 11, fig. 2.

*Molpadia similis* CLARK, The Apodous Holothurians, 1907, p. 163, pl. 10, fig. 16.

*Molpadia roretzii* CLARK, The Apodous Holothurians, 1907, p. 164.

- Station 4832. One specimen.
- Station 4945. One specimen.
- Station 5055. One specimen.
- Station 5059. Twelve specimens.
- Station 5067. Two specimens.
- Station 5069. Two specimens.
- Station 5092. One specimen.

The largest specimen measures 120 mm. in length, inclusive of the caudal appendage, which is 17 mm. long. Racket-shaped calcareous bodies in rosette-shaped groups of about 5 each, but varying from 3 to 7, mean length 485 $\mu$ , varying between 320 and 740 $\mu$ . Anchors measuring 260–495 $\mu$  in length, with a mean of 370 $\mu$ ; span of the arms 110–180 $\mu$ , with a mean of 140 $\mu$ ; and the base 70–80 $\mu$  in diameter. Scattered tables with from 1 to 9 holes, usually 4, in their small disks. Diameter of disks 46–270 $\mu$ , averaging 120 $\mu$ . Spire is 70–130 $\mu$ , with

2-6 crossbeams. The shape of these tables is also subject to a rather wide range of individual variation. Elongated tables in caudal appendage  $150-330\mu$  in length, anal teeth  $500\mu$  long and  $150\mu$  broad. Phosphatic corpuscles are uniformly distributed in young specimens, while in older ones they are aggregated into patches of about  $300\mu$  in diameter.

*Habitat*.—Japan (v. Marenzeller, 1881); Sagami Sea (Théel, 1886; Augustin, 1908; Mitsukuri, 1912); off Echizen, Honshu; Kagoshima Bay; Suruga Bay.

#### 43. MOLPADIA INTERMEDIA (Ludwig).

*Trochostoma intermedium* LUDWIG, Bull. Mus. Comp. Zool., Harvard Coll., vol. 24, No. 4, 1893, p. 113; *Albatross* Holothurioidea, 1894, pp. 161-164, pl. 16, figs. 7-21.

*Molpadia intermedia* CLARK, The Apodous Holothurians, 1907, pp. 33-34, 162, pl. 12, figs. 5-15.

Station 5039. Five specimens.

All the specimens are large, total length of body being 100-125 mm. Color uniformly grayish-purple. As unfortunately the deposits had been totally dissolved when the specimens were examined by me, my observations were made on a single preparation mounted by the late Professor Mitsukuri, and are imperfect. Scattered tables of perisome measure  $60-105\mu$  in diameter, while those in caudal appendage are  $110-230\mu$ , spire  $80\mu$  high. Except in the oral and caudal parts, skin thickly beset with phosphatic corpuscles, not unfrequently exceeding  $160\mu$  in diameter.

*Habitat*.—Gulf of Panama (Ludwig, 1894); Gulf of California (Ludwig, 1894; Clark, 1913); numerous stations along the Pacific coast of North America (Clark, 1907); off Hitaka, south of Hokkaido.

#### 44. MOLPADIA MUSCULUS Risso.

*Molpadia musculus* RISSO, Histoire Naturelle de l'Europe mérid., 1826, p. 293.—CLARK, The Apodous Holothurians, 1907, pp. 34-35, 165-166, pl. 11, figs. 2-4, 6-7, 14.

*Molpadia violacea* STUDER, Monatsber. d. königl. Akad. d. Wiss., Berlin, 1876, p. 454.

*Ankyroderma danielsseni* THÉEL, Challenger Holothurioidea, pt. 2, 1886, pp. 39-40, pl. 2, figs. 6a-g.

*Ankyroderma musculus* LUDWIG, Zeitschr. f. wiss. Zool., vol. 51, 1891, pp. 569-591, pl. 29, figs. 1-11.—PERRIER, *Travailleur* and *Talisman* Holothurioidea, 1902, pp. 529-533, pl. 22, figs. 16-22.—KÖHLER and VANEY, Les Holothuries de mer profonde, 1905, pp. 95-97.

Station 5030. Seven specimens.

The largest specimen is 70 mm. long. All these specimens lack phosphatic corpuscles completely. Anchors and rosettes of racket-shaped bodies are also wanting. The characteristic spindle-shaped deposits of general perisome measure 0.63-1.55 mm. in length, aver-

aging 1.2 mm., with 5 (3–10) holes. Very rarely in some individuals there rises from the center a solid spire with a knoblike top. Among these deposits are found small tablelike bodies, with a disk up to 0.2 mm. in diameter, perforated by 3 large holes. Spire is armed at the apex with 6 hooks. In caudal appendage rods are smaller and simpler, less than 0.8 mm. in length. Anal teeth measure only 0.4 mm. in length.

*Habitat.*—Nice (Risso, 1826); Naples (Grube, 1840; Ludwig, 1891); Palermo (Grube, 1850); Marseille (Jourdan, 1883); coasts of Portugal, Sahara, and Senegal (Perrier, 1902); Kerguelen Islands (Studer, 1876; Théel, 1886); New Zealand (Théel, 1886); off Chile (Théel, 1886; Clark, 1907); from the Gulf of Panama, Cocos and Galapagos, to California (Ludwig, 1894; Clark, 1907, 1913); numerous stations along the coasts from the Gulf of Aden to Andaman Islands (Køehler and Vaney, 1905, 1910); east of southern Sakhalin.

#### 45. MOLPADIA SPINOSA (Ludwig).

*Ankyroderma spinosum* LUDWIG, Bull. Mus. Comp. Zool., Harvard Coll., vol. 24, No. 4, 1893, pp. 113–114; *Albatross* Holothuriodea, 1894, pp. 171–173, pl. 17, fig. 10; pl. 18, figs. 1–12.—SLUITER, *Siboga* Holothurien, 1901, p. 120.—KØEHLER and VANEY, *Les Holothuries de mer profonde*, 1905, pp. 96, 97.

*Molpadia musculus* CLARK (part), *The Apodous Holothurians*, 1907, pp. 34–35, 166, pl. 11, figs. 1, 5, 9–13; Bull. Amer. Mus. Nat. Hist., vol. 32, 1913, pp. 228–229.

Station 5057. One specimen.

The body proper measures only 21 mm. in length, while the caudal appendage is 7 mm. long. Numerous tablelike deposits of general perisome (Ludwig, pl. 18, figs. 1–8) measure 200–350 $\mu$  in diameter, with a mean of 260 $\mu$ , number of holes in the disk usually 3, varying from none to 6. Between these there are a very few delicate ones (Ludwig, pl. 18, fig. 11) with a disk about 100 $\mu$  in diameter, and a spire 150 $\mu$  high. Toward the anterior and posterior regions of the body the tables become very robust and are usually beset with two processes produced in opposite directions, lying transversely to the body axis (Ludwig, pl. 18, fig. 10). These may attain the length of 700 $\mu$ . Spindle-shaped bodies which are found only in the caudal appendage are very abundant; their length varies 330–710 $\mu$ , holes 3–4 in number. Anchors and rosettes almost wanting; the racket-shaped bodies measure 540–650 $\mu$  long. Phosphatic corpuscles are clustered in patches all over the body except caudal appendage.

Though Køehler and Vaney have proved the variability of the relative length of tail and similarity in shape of spicules, there remains some doubt as to the identity of this species with *M. musculus*. The only point of distinction between the two species seems to me to lie in the different distribution of spicules. In the specimen before

me those smooth, spindle-shaped bodies are never present in general perisome.

*Habitat*.—From the Gulf of Panama to the Gulf of California (Ludwig, 1894; Clark, 1913); Flores and Banda Seas (Sluiter, 1901); Suruga Bay.

46. MOLPADIA ANTARCTICA (Théel).

*Trochostoma antarcticum* THÉEL, *Challenger* Holothurioidea, pt. 2, 1886, p. 44, pl. 2, figs. 7a-e; *Blake* Holothurioidea, 1886, pp. 16, 17.—AUGUSTIN, *Japanische Seewalzen*, 1907, pp. 35-36, text-figs. 22a-c.

*Molpadia antarctica* CLARK, *The Apodous Holothurians*, 1907, pp. 32, 168.

Station 5074. One specimen.

The specimen, which is 33 mm. in length inclusive of a very short tail, agrees very well with Théel's specimens. Phosphatic corpuscles are entirely absent, while tablelike deposits are undergoing change of color, as Théel found in the *Blake* specimens. Number of holes in disk usually 6, but may vary from 3 to 10. Diameter of disk 120-250 $\mu$ , with a mean of 185 $\mu$ , height of spire 150 $\mu$ . There is found another kind of deposits, which are minute and have a solid spire ending in three hooks. Tables of caudal appendage are smaller, with a disk of 40-110 $\mu$  in diameter, and a very robust and spinose spire consisting of 3-5 pillars.

*Habitat*.—Chile (Théel, 1886; Clark, 1907); between Florida and Cuba (Théel, 1886); off Alexander Land, Antarctic (Hérouard, 1901); Okinose, Sagami Sea (Augustin, 1908); Suruga Bay.

47. MOLPADIA DIOMEDLÆ (Mitsukuri).

*Ankyroderma diomedæ* MITSUKURI, *Actinopodous Holothurioidea*, 1912, pp. 265-267, pl. 8, fig. 77, text-fig. 54.

Station 5073. One specimen.

Of the whole collection this was the only specimen which Professor Mitsukuri was able to examine and describe. I may here make some additional statements.

Color yellowish-brown all over. Deposits are abundant and well developed, so that the integument is quite rough to the touch. Racket-shaped bodies are 550-780 $\mu$  long with a straight, smooth handle. Usually 7 or 8 of them together form a rosette, but the number may vary from 6 to 10. Anchors measure 400-460 $\mu$  in length and are in most cases broken off. Each of the arms bears 4 teeth on the outer side. Base of the anchor is 70-90 $\mu$  in diameter and is perforated with 4 primary, 4 larger, and several minute peripheral holes. Table-like bodies are very robust with a disk expanded in 2, 3, or 4, directions and perforated with numerous holes. Spire is tall, about 350 $\mu$ , consisting of 4, but rarely 3 or 5, pillars with more than 10 crossbeams and fine dentition along the outer side. Including the larger central



4, the number of holes varies 30–50, with a mean of 40. Mean diameter of disks  $420\mu$ , with a range of 270–550 $\mu$ . In caudal appendage the disks are regularly spindle-shaped, with very minute holes and a low spire.

*M. dissimilis* Clark seems to present a close resemblance to the present species. But the tables and anchors are four-rayed in our species and three-rayed in *dissimilis*.

*Habitat*.—Suruga Bay (Mitsukuri, 1912).

*Type*.—Cat. 34161, U.S.N.M.

48. MOLPADIA CLARKI, new species.

Plate 9, figs. 14a-c.

Station 4983. Two specimens.

The more or less distorted body measures 43 mm. long including the caudal appendage which is 8–12 mm. Color gray all over, with a slight tinge of purple. Integument soft but rough from the presence of anchors. Tentacles 15, each with a pair of small digits. Deposits much resembling those of *M. roretzii* but larger and more irregular. Tables (pl. 9, figs. 14a, b) have disks of irregular contour, often excentric with regard to the primary cross. Mean diameter  $200\mu$ , ranging between 110 and  $340\mu$ , holes 7 or 8 in number, varying from 2 to 24. Spire about  $160\mu$  high, composed of 3 pillars, and armed with 9 or more teeth at the top and often some more on the sides. In the anterior region these tables are small and simple. Tables of the caudal appendage (fig. 14c) are elongated, measuring 240–450 $\mu$  in length, with a spire about  $100\mu$  high. Racket-shaped bodies are about  $715\mu$  in average length, ranging between 460 and  $840\mu$ , similar in shape to those of *M. roretzii* but plumper and with smaller holes. A rosette is composed of 5 of these bodies in most cases, but the number may vary from 3 to 10. Anchors measure 480–520 $\mu$  in length, with a base 80–105 $\mu$  in diameter, and bearing on each arm 4, or sometimes 3 or 5, prominent teeth. Anal teeth forked at base, measuring 600 $\mu$  by 300 $\mu$ . Phosphatic corpuscles about 30–120 $\mu$  in diameter. Radial segments of calcareous ring have a rather long posterior prolongation bifurcated at the end. Polian vesicle and stone canal single. Respiratory trees 2, the right one being twice as long as the other.

The present species differs from *M. productamensis* Clark in some minor points. In this Japanese species the bifurcation of posterior prolongations of calcareous ring is not very deep, spire of tables has fewer crossbeams, and elongated tables in caudal appendage are larger and more robust. It is my great pleasure to name this species for Dr. Hubert Lyman Clark, of the Museum of Comparative Zoology, Harvard College.

*Habitat*.—Off the coast of Shiribeshi, Hokkaido.

*Type*.—Cat. No. 34162, U.S.N.M.

49. *MOLPADIA INFESTA*, new species.

Plate 9, figs. 15a, b.

Station 4812. One specimen.

Body fusiform, 60 mm. long, including the caudal appendage, which is about 5 mm. in length and not distinctly set off from the rest of body. Color grayish-brown, integument rough to the touch. Tentacles 15 in number, each with a pair of minute digits. Deposits of perisome are tables only (pl. 9, fig. 15a). Disks averaging  $250\mu$  in diameter, with a range of  $175\text{--}310\mu$ , usually with 3 holes, often none, or in some cases with smaller peripheral ones, numbering up to 14 in all. Spire is made up of 3 pillars armed with some teeth on the top and sides, and connected with each other by 3 crossbeams, height ranging between 120 and  $170\mu$ . In the caudal appendage tables are modified into elongated plates without spire, but often with knobs (fig. 15b). Length of these plates varies  $280\text{--}380\mu$ , holes numbering from 4 to 20 or more. Phosphatic corpuscles are irregularly dispersed measuring in most cases  $30\text{--}80\mu$  in diameter. Calcareous ring similar in form to that of *M. intermedia*. Polian vesicle and stone-canal single. Respiratory trees two, the right one much larger than the other.

The present species resembles *M. clarki* but differs from it in some points relating to deposits, from *M. intermedia* in shape of deposits of the tail, and from *M. andamanensis* (Walsh) in shape of tables in general perisome. The specimen is severely infested by a species of Gregarina encysted at several parts, such as radial muscles, mesenteries, intestinal blood vessels, etc.

*Habitat*.—North of Sado Island, Japan Sea.

*Type*.—Cat. No. 34163, U.S.N.M.

## Genus CAUDINA Stimpson.

50. *CAUDINA LUDWIGI*, new species.

Plate 9, figs. 17a-c.

Station 5085. A fragment.

Only a posterior part is left, measuring 73 mm. long, 12 mm. in diameter at the thickest part, the posterior two-thirds 6 mm. in diameter throughout. Color dirty white, integument transversely wrinkled, stiff, and very rough to the touch. Deposits very abundant, overlapping one another, in two forms but not arranged in distinct layers. One form is spinose and tablelike (pl. 9, figs. 17a, b), with an angular disk perforated with 17-55 holes and a conical spire consisting of 3, rarely 4 or 5, pillars united together by 3 or 4 crossbeams. Diameter of the disk  $270\text{--}410\mu$ ; height of spire  $160\text{--}200\mu$ . The other form, which is very sparsely found, is a smaller, spinose plate

with larger holes, measuring 220–280 $\mu$  in diameter (fig. 17c). No anal teeth and papillæ are found. No account concerning tentacles and viscera can be given for want of the anterior part of body.

The present species very much resembles *C. californica* Ludwig, but differs from it in having tables besides the spinose plates. I take much pleasure in dedicating this new species to the late Prof. Hubert Ludwig of the University of Bonn.

*Habitat*.—Sagami Sea.

*Type*.—Cat. No. 34164, U.S.N.M.

## Family CUCUMARIIDÆ Ludwig.

### Genus CUCUMARIA Blainville.

#### 51. CUCUMARIA JAPONICA Semper.

*Cucumaria japonica* SEMPER, *Holothurien*, 1868, p. 236, pl. 31, fig. 5; pl. 33, fig. 7; pl. 34, fig. 10; pl. 38, figs. 5, 6, 8, 9, 12, 13; pl. 39, figs. 2, 3, 7, 18.—BRITTEN, *Holothurien a. d. japan. u. ochotsk. Meere*, 1907, pp. 133–135.—AUGUSTIN, *Japanische Seewalzen*, 1908, pp. 25–26, text-fig. 18.—EDWARDS, *Four Species of Pacific Holothurians*, 1910, pp. 603–604, pl. 19, figs. 15–16.—MITSUKURI, *Actinopodous Holothurioidea*, 1912, pp. 242–246, pl. 8, figs. 67, 68, text-fig. 48.

Mororan. One specimen.

Station 5010. One specimen.

Unknown locality. One specimen.

The largest specimen is 145 mm. long, 85 mm. in transverse diameter. Besides the deposits already known there are found in the introvert massive, elongated plates with irregular ridges near the center, like those known in *C. frondosa* (Gunner).<sup>1</sup> Mean length of these bodies is 450 $\mu$ , range being 230–580 $\mu$ .

*Habitat*.—Japan (Semper, 1868); Moluccas (Sluiter, 1895); Aniwa Bay; Terpyeniya Bay; and Busse Bay, Sakhalin; Amur Bay; Askold Island; Chalezov Island; and Cape Nasimov (Britten, 1907); Trakaku Islands; Nemuro, Hokkaido; and Onagawa Bay, Ojika Peninsula (Augustin, 1908); Hakodate (Edwards, 1910; Mitsukuri, 1912); Ojika Peninsula; Atkeshi, Kushiro, Hokkaido (Mitsukuri, 1912); Mororan, Hokkaido.

#### 52. CUCUMARIA MINIATA (Brandt).

*Cladodactyla (Polyclados) miniata* BRANDT, *Prodromus*, 1835, p. 44.

*Cucumaria miniata* SELENKA, *Beiträge zur Anatomie und Systematik der Holothurien*, 1867, p. 350.—EDWARDS, *Four Species of Pacific Holothurians*, 1910, pp. 604–607, pl. 19, figs. 17–21.

*Cucumaria albida* SELENKA, *Beiträge zur Anatomie und Systematik der Holothurien*, 1867, p. 350, pl. 20, fig. 109.

*Cucumaria japonica* LAMPERT (not Semper), *Seewalzen*, 1885, p. 143.—CLARK, *Zool. Anz.*, vol. 25, No. 677, 1902, pp. 562, 564.—EDWARDS, *Albatross Holothurians*, 1907, pp. 61–62.

Dockton, Puget Sound, Washington. Two specimens.

<sup>1</sup> See Edwards, *Revision*, vol. 1, 1910, pl. 13, fig. 19.

The larger specimen is in formalin, and measures 72 mm. long and 14 mm. in diameter. Except that the end plate of pedicels is always single, the specimens well answer to the description given by Edwards. *Habitat*.—Pacific coast of North America.<sup>1</sup>

#### 53. CUCUMARIA CALIFORNICA Semper.

*Cucumaria californica* SEMPER, *Holothurien*, 1868, p. 235, pl. 39, fig. 16; pl. 40, fig. 10.—EDWARDS, *Four Species of Pacific Holothurians*, 1910, pp. 601-603, pl. 19, figs. 5-14.

*Cucumaria frondosa* EDWARDS, *Albatross Holothurians*, 1907, pp. 59-60.

Station 4777. One specimen.

Station 4778. One specimen.

Station 4779. One specimen.

Station 4784. One specimen.

Medni Island on fish line. One specimen.

The largest specimen, very strongly contracted, measures 135 mm. by 80 mm. The general body configuration is very like that of *C. japonica*, while *C. miniata* is distinguishable from both of them by its being markedly elongated.

*Habitat*.—From the North Pacific Ocean to the Galapagos.<sup>2</sup>

#### 54. CUCUMARIA CHRONHJELMI Théel.

*Cucumaria chronhjelmi* THÉEL, *Challenger Holothurioidea*, pt. 2, 1886, p. 105.—CLARK, *Echinoderms from Puget Sound*, 1901, p. 334, pl. 4, figs. 11-20.—MITSUKURI, *Actinopodous Holothurioidea*, 1912, pp. 235-238, pl. 8, figs. 71-72, text-fig. 46.

Dockton, Puget Sound, Washington. Six specimens.

The largest specimen, with contracted introvert, measures 90 mm. in length and 30 mm. in diameter. In the introvert reticulated cups are slightly larger and more regular in shape than those in general perisome. The greater diameter averages 80 $\mu$ , with a range of 54-130 $\mu$ . There are, besides these, elongated plates, 350 $\mu$  long, with reticulated knobs.

*Habitat*.—Vancouver Island (Théel, 1886); Pacific Grove, California; and Puget Sound, Washington (Clark, 1901); Dock, Port Townsend, Washington (Edwards, 1907); Pacific coast of Japan from Hokkaido to Province Shima (Mitsukuri, 1912).

#### 55. CUCUMARIA VEGÆ Théel.

*Cucumaria vegæ* THÉEL, *Challenger Holothurioidea*, pt. 2, 1886, p. 114.—CLARK, *Zool. Anz.*, vol. 25, No. 677, 1902, p. 563.—EDWARDS, *Albatross Holothurians*, 1907, p. 59.—MITSUKURI, *Actinopodous Holothurioidea*, 1912, pp. 255-257, pl. 1, fig. 9.

Dutch Harbor, Unalaska Island. Eight specimens.

Unalaska. Twenty-two specimens.

<sup>1</sup> See Edwards, 1910, p. 607.

<sup>2</sup> Idem, pp. 602-603.

Nazan Bay, Atka Island. Eleven specimens.

Agattu Island. Eight specimens.

Nikolski, Umnak Island. Twenty-one specimens.

Milne Bay, Simushir Island, Kuriles. Five specimens.

The largest specimen is 75 mm. long and 14 mm. wide. The spectacle-like deposits, with 0-6 holes in each half, measure 50-220 $\mu$  in length, with a mean of 120 $\mu$ . Those modified into perforated plates are more frequently found in young than in older ones, and may measure 200 $\mu$  in diameter with holes numbering up to 40. End-plates of pedicels are rudimentary or utterly wanting, measuring 62-135 $\mu$  in diameter. The introvert seems to be destitute of deposits, except in pedicels.

*Habitat*.—Bering Island (Théel, 1886); St. Paul, Pribilof Islands; and Copper Island (Clark, 1902); Sitka (Clark, 1902); Shakan Beach, southeast Alaska (Edwards, 1907); Hokkaido (Mitsukuri, 1912).

56. CUCUMARIA CALCIGERA (Stimpson).

*Pentacta calcigera* STIMPSON, Proc. Boston Soc. Nat. Hist., vol. 4, 1851, p. 67.

*Cucumaria calcigera* SELENKA, Beiträge zur Anatomie und Systematik der Holothurien, 1867, p. 351.—DUNCAN and SLADEN, A Memoir on the Echinodermata, 1881, pp. 5-8, pl. 1, figs. 3-8.—BELL, Journ. Roy. Micr. Soc., ser. 2, vol. 3, 1883, p. 481, pl. 8, figs. 2, 2a.—LUDWIG, Echinodermen des Beringsmeeres, 1886, pp. 277-279, pl. 6, figs. 1-5; Arktische und subarktische Holothurien, 1900, pp. 146-147.—KALISCHEWSKI, Echinodermenfauna d. sibir. Eismeer, 1907, p. 4.—BRITTEN, Holothurien a. d. japan. u. ochotsk. Meere, 1907, pp. 136-137.—EDWARDS, Albatross Holothurians, 1907, pp. 54-59, text-figs. 5-11.

Station 4903. One specimen.

Station 5000. One specimen.

Station 5001. One specimen.

Station 5002. One specimen.

Station 5003. Three specimens.

Station 5004. Five specimens.

The specimen from station 4903 differs from the rest in having the pedicels all retracted and the introvert extended, and in having spicules markedly smaller than in others. It is a wonder that this arctic species occurs in such warm regions.

*Habitat*.—To the localities given by Ludwig (1900) and Edwards (1907) the following may be added: Fox Harbor, St. Louis Sound, Newfoundland (Bush, 1884); Sabacheyago, Murman coast (Derjugin, 1906); south of Bennett Islands (Kalischewskij, 1907); west coast of Sakhalin (Britten, 1907). From Kalischewskij's report it can scarcely be doubted now that this species is completely circumpolar in distribution.

57. *CUCUMARIA GLACIALIS* Ljungman.

*Cucumaria minuta* STUXBERG (not Fabricius), Öfv. af kongl. Vet. Akad. Förhandl., 1878, p. 27.

*Cucumaria glacialis* LJUNGMAN, Öfv. af kongl. Vet. Akad. Förhandl., 1879, pp. 128-129.—MORTENSEN, Zeitschr. f. wiss. Zool., vol. 57, 1894, pp. 704-732, pls. 31-32.—LUDWIG, Arktische und subarktische Holothurien, 1900, pp. 144-145.—KALISCHEWSKIJ, Echinodermenfauna d. sibir. Eismeerer, 1907, pp. 3-4.—BRITTEN, Holothurien a. d. japan. u. ochotsk. Meere, 1907, pp. 137-138.

Station 4795. One specimen.

The specimen is a male, measuring 40 mm. in length in contracted state. No account need be added to the excellent descriptions given by Mortensen and Britten.

*Habitat*.—Besides the localities given by Ludwig (1900) the following may be added: Stor-Fjord, Spitzbergen; and vicinity of Novaja-Semlja (Michailowskij, 1902, 1904); Nordenskjöld Sea; and north of New Siberia Islands (Kalischewskij, 1907); Ochotsk and Japan Seas (Britten, 1907); east coast of Kamchatka.

58. *CUCUMARIA CAPENSIS* Théel.

*Cucumaria capensis* THÉEL, *Challenger* Holothurioidea, pt. 2, 1886, pp. 62-64 pl. 5, fig. 2.—LUDWIG, Alte und neue Holothurienarten, 1887, p. 1236.—SLUITER, *Siboga* Holothurien, 1901, p. 80, pl. 7, fig. 4.

*Cucumaria tegulata* AUGUSTIN, *Japanische Seewalzen*, 1908, pp. 24-25, text-figs. 16, 17.

*Cucumaria capensis*, var. *parva* MITSUKURI, *Actinodous* Holothurioidea, 1912, pp. 233-235, pl. 8, fig. 74, text-fig. 45.

Station 4900. Four specimens.

Station 4903. One specimen.

The largest specimen is only 10 mm. long. The Japanese specimens reported on under the above-mentioned names by Augustin and Mitsukuri are doubtless identical with Théel's. As Ludwig had only a small specimen, 15 mm. long, under observation, I can not follow Mitsukuri in separating the Japanese form as a variety.

*Habitat*.—Off Cape of Good Hope (Théel, 1886); Cape Town (Ludwig, 1887); Moro Strait; southwest of Timor; and Sulu Archipelago (Sluiter, 1901); Uruga Channel (Augustin, 1908); Jogashima and Moroiso, Misaki (Mitsukuri, 1912); off Goto Islands, west of Kyushu.

59. *CUCUMARIA IJIMAL*, new species.

Plate 10, figs. 18a-c.

Station 4784. Seventy-one specimens.

Body ovoid, measuring 31 mm. long and 14 mm. broad, with mouth and anus turned dorsad. Color white all over, with a light cream tinge; integument thin and semitranslucent, smooth to the touch. Tentacles 10, very small and of uniform size. Pedicels in a double

row along the odd ambulacrum, in a single row in each ventrolateral ambulacrum. In the largest specimen there are 34 pedicels in the odd ambulacrum, 20 and 22 respectively in the paired ambulacra. In each dorsal ambulacrum there are at most 7 knoblike pedicels in a single row; a few similar knobs are present at the anterior ends of the ventral ambulacra. In young specimens the dorsal ambulacra are almost destitute of appendages. Interambulacra are completely naked. Deposits are of a characteristic form, being delicate, smooth rods with both ends branched once or twice dichotomously (pl. 10, figs. 18*a*, *c*). Their length varies 45–180 $\mu$ , with a mean of 94 $\mu$ . These are by no means crowded but are quite sparse, especially in dorsum. Between them there are deposits of another form, simple rods with a joint at the middle (fig. 18*b*), with the average length of 63 $\mu$ , varying 25–107 $\mu$ . Probably these are early stages of the above-mentioned branched bodies. Single deposits heavy at the posterior end but no anal teeth can be found, those of introvert not distinguishable from those of general perisome. In pedicels and papillæ deposits are numerous, much branched, sometimes nearly forming a perforated plate. End plates of pedicels well developed, measuring 405–670 $\mu$  in diameter. Supporting bodies of tentacles are irregular rods and large, curved, perforated plates. Calcareous ring quite weakly calcified, without posterior prolongations. Retractors thin and threadlike, inserted to body wall about one-fourth the body length from the anterior end. Polian vesicle and stone-canal single. Respiratory trees two, rudimentary, measuring only 6 mm. in length, with a few finger-shaped branches. Genital tubes unbranched, about 20 mm. long and 1 mm. thick, in two tufts of a few tubes each. Ovarian ova measure 0.5–0.55 mm. in diameter. Genital papilla situated between the mid-dorsal tentacles.

In all females above 10 mm. in length, a pair of brood pouches are present in the ventral interambulacra, about 3–4 mm. behind the tentacular crown. When filled with young these pouches occupy almost the whole body cavity; thus, in a specimen 16 mm. long, the right pouch measured 11 mm. by 7 mm. and the left one 8 mm. by 6.5 mm. The wall of the pouch is very thin and transparent, and without deposits. So far as my examinations extended, the young were all in the same stage of development. In the specimen just referred to, there were 12 young in the right pouch and 7 in the other. In an extreme case 16 young were contained in a single pouch.

The size of the young observed by me varied in length between 2 and 7 mm. with a mean of 5 mm., and in diameter between 1 and 4 mm. with a mean of 3 mm. Some of their characteristics may be given. Body wall very thin and transparent, so that the internal organs are easily visible from outside. Around the mouth, which is already open, there are 10 quite short tentacles with a few branches.

Six or seven pedicels are present in each ventral ambulacrum, none observed so far in the bivium. Deposits frequently present at the posterior end of body and in pedicels, but very rare in other parts. They are simple rods and may have both ends forked. The wall of the stone-canal and its openings with quite a mass of simple rods. The internal organs to be noted are: 10 segments of the calcareous ring formed as a loose network; 5 longitudinal muscles with slender retractors; a single Polian vesicle; a stone-canal inserted to body wall; a pair of rudimentary genital organs attached to dorsal mesentery; and the alimentary canal in the form of a somewhat drawn-out spiral, with a pair of rudimentary respiratory trees at the beginning of the cloaca. At the point where the stone-canal reaches the body wall, the canal is dilated into a flat cavity extending posteriorly and branched like roots, with external opening at each end.

Of the known species of *Cucumaria*, *C. abyssorum* Théel perhaps stands nearest to this species, but it lacks the brood pouches and the deposits are very different. I take great pleasure in naming this most interesting form for Prof. Isao Ijima, of the Science College, Tokyo Imperial University.

*Habitat.*—Aleutian Islands.

*Type.*—Cat. No. 34165, U.S.N.M.

60. *CUCUMARIA LAMPERTI*, new species.

Plate 10, figs. 19a-b.

Station 4778. Four specimens.

Station 4779. One specimen.

Station 4784. Forty-six specimens and twenty-nine young born after capture.

Station 4786. One specimen.

Station 4792. One specimen.

Body ovoid, 34 mm. long. and 14 mm. broad, with both ends turned dorsad. Color white or tinged with light yellow, integument stiff and rough to the touch from the presence of abundant deposits. Tentacles 10, very short, midventral pair much smaller than the rest. Pedicels confined to the ambulacra, in double rows in trivium, in one case 44 in the midventral, 37 and 38 in each ventrolateral ambulacrum. In younger specimens the ventrolateral ambulacra had only single rows of pedicels. In the bivium they are generally reduced and papilla-like, numbering 5 to 10 in each ambulacrum. But in some individuals there is a complete double row of well-developed pedicels, numbering 30 in each. Deposits in the form of thick, knobbed plates of various sizes (pl. 10, fig. 19a) are very abundant, especially in ventral perisome. The small ones are smooth, button-shaped and bear at one end some spines (fig. 19b), which become obscured in very large ones. These plates lie imbricated, with the spinous end



obliquely overlapping the neighboring one. Their greater diameters range from 20 to  $660\mu$ ; holes 4 to over 60 in number. Deposits in the introvert are scattered, knobbed plates usually oblong in outline, destitute of spines. These range  $95\text{--}220\mu$  in diameter, holes varying in number from one to above 10. Anal teeth 5, well developed. Pedicels are supported with rather delicate, smooth plates and an end-plate, well developed in ventral pedicels but quite rudimentary in those of dorsum. Supporting bodies of tentacles are either rod-like or plate-like, knobbed or smooth. Calcareous ring tolerably well developed, without posterior prolongations. Retractors inserted to body-wall a little anterior to the middle of body. Polian vesicle and stone-canal single. Respiratory trees two, measuring at most 5 mm. in length, with a few branches. Genital tubes unbranched, in 2 tufts of a few tubes each. Ovarian ova measure about 0.8 mm. in diameter. Genital papilla is found between the middorsal pair of tentacles.

In female specimens a pair of brood pouches are found on the ventral side, a little anterior to the middle of body. The pouch even when filled with young is not spacious, measuring at most only 4.5 mm. in diameter. The wall of the pouch is very thin and contains no deposits. In a specimen 16 mm. long, there were 14 young in the right pouch, all polyhedral in shape from mutual pressure. The 29 young contained in the same bottle were probably born after the capture of their mother, and are in the same stage of development as those contained in the pouch but are quite plump and oval in shape.

The lengths of the young range 1.8–3.2 mm. Body wall is very thick, of a cream color and opaque. Tentacles 10, slightly branched at end, midventral pair smaller than the others. Mouth is not yet open, a massive wall forming a low prominence over it. Pedicels present only in trivium, numbering 5–7 in each ambulacrum. In perisome are scattered X-shaped plates with dichotomously branched arms, like those known to occur in the young of *C. parva* Ludwig.<sup>1</sup> In pedicels are found X-shaped deposits similar to, but markedly smaller than, those of body surface. End plate single, sometimes with several holes. Calcareous ring in the form of a network; retractors and longitudinal muscles well developed. Polian vesicle single, stone-canal attached to the body wall but not opening externally (?). Alimentary canal coiled, with thick muscular wall. Yolk granules are abundantly found in body wall, body cavity, alimentary canal, and water-vascular system.

The present species is very closely allied to the antarctic *C. lævigata* (Verrill), while the peculiarities observed in the young agree very well with those known for *C. glacialis* as reported by Mortensen, who, however, found three stages contained in a single pouch. The

<sup>1</sup> See Ludwig, Hamburger Magalhãensische Sammelreise, 1898, pl. 1, fig. 16.

species is named for Prof. Kurt Lampert of Stuttgart, with reference to his first discovery of a cucumarid with brood-pouches.

*Habitat.*—Aleutian Islands and vicinity of Commander Islands.

*Type.*—Cat. No. 34166, U.S.N.M.

61. *CUCUMARIA SPINOSA*, new species.

Plate 10, figs. 20a-c.

Station 5043. One specimen.

Station 5046 or 5047. Four specimens.

Station 5053. One specimen.

Body fusiform and strongly curved, with a long tapering posterior prolongation, as in *C. calcigera*. The largest specimen is 68 mm. long and 10 mm. across. Color white, integument thin and stiff, rough to the touch. Tentacles strongly retracted together with introvert, ventral two being smaller than the rest. Pedicels knob-like, arranged in an irregular zigzag row in each ambulacrūm; above 30 pedicels in a row in the bivium, above 50 in the trivium. Interambulacra naked. Anal papillæ five. Deposits of perisome are elongated oval buttons, thickest at the middle, with a tail-like process at the broader end (pl. 10, figs. 20a, b). There are 2, seldom 3, rows of holes, usually 8 or 9 in number, but varying from 4 to 25. The tail-like process has a small hole and a pair of short spines at its end. As may be seen from comparison with an early stage (fig. 20c), these deposits are developed along an axis making an angle of about 30° with that of the primary cross. Length varies 125–400 $\mu$ , thickness about 35 $\mu$ . They lie thickly imbricated, with the tail-like process turned backward and obliquely protruding from skin. In the introvert deposits are thinly scattered delicate plates. Anal teeth quite rudimentary. In pedicels are found bent, irregular, rod-like plates, and an imperfect end-plate represented by delicate, branched rods. Supporting rods of tentacles are irregularly perforated. Calcareous ring consists of ten high, narrow segments, radials about 3 mm. long, deeply notched posteriorly but without prolongations. Retractors slender, inserted to body wall at about one-third the length of contracted body. Polian vesicle single, stone-canal also single with a large fungiform madreporite. Respiratory trees 4, 2 on each side, over 20 mm. in length, opening into the anterior end of the cloaca, which is 30 mm. long. Genital tubes unbranched.

The present species resembles *C. koræensis* Östergren in many respects, but differs in shape of deposits and anal teeth. The characteristic spicules remind one of those of *C. fallax* Ludwig as figured by Edwards.<sup>1</sup>

*Habitat.*—Off Hitaka, Hokkaido; off Ojika Peninsula; Suruga Bay.

*Type.*—Cat. No. 34167, U.S.N.M.

<sup>1</sup> Four species of Pacific Holothurians, 1910, pl. 19, fig. 22.

## 62. CUCUMARIA SLUITERI, new species.

Plate 10, figs. 21a, b.

Station 5079. One specimen of doubtful specific identity.

Station 5082 or 5083. Two specimens.

Body elongated oval, 11 mm. in length and 5 mm. in diameter, with mouth and anus terminal. Color gray, integument thin and translucent. Tentacles 10, all equal in size. Pedicels are arranged in a row along each ambulacrum, each row consisting of 10 pedicels in trivium and of 3 or 4 in bivium. Scattered in dorsal perisome are found X-shaped, tablelike deposits (pl. 10, figs. 21a, b). The arms may number up to 7, and the ends are dilated and perforated. Spire is solid, situated on one of the arms near its base, and bears irregular teeth. Diameter of base ranges 210–380 $\mu$ , with a mean of 300 $\mu$ ; height of spire commonly 150 $\mu$ . Near the introvert these tables become plumper, and the spire is replaced by an arm arising obliquely from the basal plane, exactly as in *C. abyssorum*.<sup>1</sup> The introvert as well as the greater part of ventrum are devoid of spicules. Pedicels are supported with bent rods, 300 $\mu$  long, with a thick branch given out from the middle. End plate single, rather weakly developed. Supporting rods of tentacles are similar to those of pedicels. No anal teeth can be made out. Calcareous ring fragile, without posterior prolongations. Retractors very slender, inserted to body wall at one-third of body length from the anterior end. Polian vesicle single. Genital tubes thick and short, unbranched.

This interesting species stands very close to *C. abyssorum*, in which, however, those delicate X-shaped tables are not present. *C. nocturna* Sluiter is also a close ally to this species, but differs in the tentacles being not all of uniform size and the dorsal pedicels being long and stiff, and in some characters of deposits. I take pleasure in naming this species for Prof. C. Ph. Sluiter, of the University of Amsterdam.

With much hesitation I refer a specimen from station 5079 to this species. All calcareous bodies are dissolved, only leaving rods 75–130 $\mu$  long, with bifurcated ends. Each of these bodies supports a conical papilla, 40–160 $\mu$  long, scattered all over the body. Probably these are the remnants of the spires of those X-shaped tables.

*Habitat*.—South of Totomi, Honshu.

*Type*.—Cat. No. 34168, U.S.N.M.

## 63. CUCUMARIA CONSTRICTA, new species.

Plate 10, figs. 22a, b.

Station 4880. One specimen.

Station 4903. One specimen.

Body strongly curved, with the large introvert protruded from the constricted anterior end. Length about 23 mm., diameter about

<sup>1</sup> See Théel, *Challenger Holothuriodea*, pt. 2, 1886, p. 67, pl. 4, fig. 6b.

6 mm. Color white, introvert and tentacles tinged with brown; integument stiff, rough to the touch. Tentacles 10, midventral pair being smaller than the others. Pedicels nonretractile, confined to ambulacra, along each of which they form a double row, of about 60 pedicels in bivium, and 70 in trivium. Table like deposits (pl. 10, figs. 22a, b) are very abundant in general perisome. Disk is elongated, with 3-10 holes and wavy margin, 73-240 $\mu$  in diameter. Those lying externally measure 160 $\mu$  in average diameter, being smaller than those of the inner, which are about 200 $\mu$  on an average. Spire, 50-60 $\mu$  high, consisting of two pillars united by a crossbeam, and armed with 6-8 teeth at the top. There are found between these bodies larger smooth plates without spire. In the introvert are scattered very delicate tables with oval disk and zigzag margin, 60-240 $\mu$  in diameter, with 10-40 holes and a spire 12 $\mu$  high. No anal teeth are found. Pedicels are supported with bent, modified tables with narrowed disk, measuring 120-190 $\mu$  long, with 4 holes at the middle and 1-3 holes at each end. Spire about 33 $\mu$  high, consisting of two pillars united at the top, armed with three teeth. Supporting rods of tentacles are very irregular and spinous. End plate well developed, 260 $\mu$  in diameter, often wheel-like as in *Thyone venusta* Selenka.<sup>1</sup> Calcareous ring massive, with long posterior radial prolongations.

Polian vesicle single; stone-canal also single, with a large, kidney-shaped madreporite. Respiratory trees two, genital tubes unbranched.

From *C. perdita* K  hler and Vaney the present species differs only in the absence of pedicels from the interambulacra. This species also resembles *C. calcigera* in shape of tables, calcareous ring, and madreporite. But the considerable size of end plate, shape of tables in the introvert, absence of the deeper layer of elongated plates, etc., distinguish it from all others.

*Habitat*.—Genkai Sea, north of Kyushu; off Goto Islands, west of Kyushu.

*Type*.—Cat. No. 34169, U.S.N.M.

64. CUCUMARIA, species (juv.).

Station 5087. Four specimens.

Body cylindrical, with truncate anterior and dorsally curved posterior end. The largest specimen is only 11.5 mm. long and 5.5 mm. in diameter. Color brownish-white, integument stiff and rough. Tentacles 10, 2 ventral markedly smaller than the others. Pedicels not retracted; arranged in a single row in each ambulacrum, very few in bivium. Deposits in the form of smooth, elliptic plates with wavy margin and slightly spinous ends, 170-320 $\mu$  in length, with 4-17 holes. Introvert, tentacles, and pedicels with rods which are often branched,

<sup>1</sup> See Selenka, Nachtrag, 1868, pl. 8, fig. 12.

and have some holes in the extremities, measuring 240–440 $\mu$  in length. End plate weakly developed, only represented by branched rods. Anal teeth well developed. Calcareous ring without posterior prolongations. Polian vesicle and stone-canal single. Respiratory trees 2, with a few branches. Genital tubes unbranched.

I thought at first that these specimens were the young of *C. echinata* v. Marenzeller, which is quite common in Sagami Sea, since in a young stage the deposits of its perisome do not show the characteristic spine and knobs. But in the present species the plates are more numerous than in *C. echinata* of corresponding age, the spinous plates are absent from pedicels, and the end plates are less perfectly formed. From *C. capensis* this species seems to differ in deposits.

*Habitat*.—Sagami Sea.

65. CUCUMARIA MOSAICA Kœhler and Vaney.

*Cucumaria mosaica* KœHLER and VANÉY, Description d'Holothuries nouvelles, 1910, pp. 98–99, pl. 2, figs. 1–5.

Station 5074. One specimen.

Body about 21 mm. long, 5 mm. in diameter. Tentacles 10, midventral pair very much smaller than the rest. The lenticular deposits composed each of 3 or more layers of knobbed plates connected by means of trabeculae measure 180–450 $\mu$  in diameter and 80 $\mu$  in thickness. Mingled with these large plates are found a few spinous tables with two-pillared spire. Diameter of disk 63–130 $\mu$ , height of spire 25–35 $\mu$ . Between these two sorts there are all stages of transitional forms. In the introvert elliptic plates, 80–120 $\mu$  long, with more or less rudimentary spire are very abundant. There are found, besides these, complicated rosettes near base of tentacles. In pedicels a weakly developed end plate without any regular, rounded margin is present, besides the arched, modified tables described from the original specimen. Supporting rods of tentacles are delicate or elegant rods, with a pair of large holes at the middle and a second of minute ones. The large lenticular bodies are totally absent near the anus, while the tablelike ones are here abundant. Anus guarded with 5 simple perforated plates. Polian vesicle single; stone-canal also single, with a two-lobed, minute madreporite. Retractors weakly developed, inserted to body wall at one-third the body length. Genital tubes unbranched in two tufts. At the tip of each tube is found a needle-like spicule, 250–650 $\mu$  long, with two minute holes near the middle. Respiratory trees, 2, the right branch being very long.

Kœhler and Vaney had only one eviscerated specimen, with which the specimen before me agrees in every essential character; only the lenticular bodies are more robust and knobbed, and the smaller plates are provided with a spire.

*Habitat*.—Persian Gulf (Kœhler and Vaney, 1910); Suruga Bay.

## 66. CUCUMARIA GLOBOSA, new species.

Station 4891. One specimen.

Body sphaerical, with mouth and anus situated on the dorsal side, not forming any sort of conical siphon, being contracted and scarcely projecting beyond the general body surface. Length, 9.5 mm.; height, 8.5 mm. Color dirty white, integument stiffened by scale-like plates. Tentacles 10, of which midventral pair probably smaller. Pedicels very minute, arranged in 2 rows in each ambulacrum, though very sparse in dorsum where the zonal arrangement is also obscured. The large scalelike plates of body wall are rounded, measuring 0.9–1.5 mm. in diameter, with serrated margin. They resemble in structure very much those of *Sphaerothuria*, only differing in that the spine is very much reduced or totally absent. Some of them have a round hole or a marginal incision, through which a pedicel passes out. The introvert contains oblong, perforated plates, slightly knobbed, measuring 140–180 $\mu$  long. Tentacles are supported with curved plates or rods, slightly knobbed, 200–330 $\mu$  in length. Supporting rods of pedicels are irregularly branched or perforated, sometimes knobbed, measuring 73–120 $\mu$  in length. End plate 80–100 $\mu$  in diameter. Calcareous ring consists of 10 segments, without posterior prolongations. Respiratory trees small, with a few branches. Genital tubes unbranched. Further details of internal organization can not be given owing to the badly injured condition of the specimen.

In spite of its resemblance to *Sphaerothuria bitentaculata* Ludwig and *Ypsilothuria talismani* Perrier in external features, this species differs in having 10 ramified tentacles, none of which are especially larger. *Psolidium sphaericum* Sluiter is very closely allied to the present species, but its scalelike deposits are smaller in ventrum than in dorsum and have each 3–8 spines.

*Habitat*.—Off Goto Islands, west of Kyushu.

*Type*.—Cat. No. 34170, U.S.N.M.

## Genus SPHÆROTHURIA Ludwig.

## 67. SPHÆROTHURIA BITENTACULATA Ludwig.

*Sphaerothuria bitentaculata* LUDWIG, Bull. Mus. Comp. Zool., Harvard Coll., vol. 24, No. 4, 1893, pp. 112–113; *Albatross* Holothurioidea, 1894, pp. 141–155, pl. 12, figs. 16–17; pl. 14, figs. 5–14.—MITSUKURI, Annot. Zool. Japon., vol. 1, pt. 4, 1897, p. 149.

*Ypsilothuria bitentaculata* KÖHLER and VANEY, Les Holothuries de mer profonde, 1905, pp. 87–88.

Station 4906. One specimen.

Station 4913. One specimen.

Station 5054. Twenty-one specimens.

Station 5055. One specimen.

Station 5057. Six specimens.

Station 5088. Nine specimens.

Station 5093. Ten specimens.

The characteristic spines borne by the scalelike plates measure at most 1.02 mm. in length, commonly 0.5–0.7 mm., and 0.3 mm. in diameter. As can be seen in those broken near the base, the spine is composed of a bundle of several pillars, connected with each adjoining one by slender crossbeams arranged in concentric circles.

I take the genus to be characterized by the presence of 8 tentacles, regardless of their shape and relative size. According to this definition the name *Ypsilothuria* is not synonymous with *Sphærothuria*. That genus, as represented by *Y. talismani* Perrier, seems to be referable to the comprehensive genus *Cucumaria*, through such transitional forms as *Echinocucumis typica* Sars, *Psolidium sphaericum* Sluiter, etc.

*Habitat*.—Pacific coast of tropical America, from Cape San Francisco and Galapagos Islands to Lower California (Ludwig, 1894; Clark, 1913); Celebes, Moluccas, and Sunda Islands (Sluiter, 1901); Laccadives, Ceylon, and Andaman Islands (Kœhler, 1898; Kœhler and Vaney, 1905); Uruga Channel and Sagami Bay (Mitsukuri, 1897; Augustin, 1908); off Koshiki Islands, west of Kyushu; Suruga Bay. While in the tropical seas the bathymetrical range of this species is very considerable, being from 131 fathoms (India) to 2,232 fathoms (tropical America), in the temperate regions, such as Lower California and Japan, the animal lives in depths not exceeding 400 fathoms.

#### Genus COLOCHIRUS Troschel.

##### 68. COLOCHIRUS INORNATUS v. Marenzeller.

*Colochirus inornatus* v. MARENZELLER, Neue Holothurien von Japan und China, 1881, pp. 130–132, pl. 5, figs. 7, 7a.—THÉEL, *Challenger* Holothurioidea, pt. 2, 1886, pp. 77–78, 120, pl. 6, fig. 8.—MITSUKURI, Actinopodous Holothurioidea, 1912, pp. 221–224, pl. 8, fig. 73, text-fig. 40.

Station 4875. One specimen.

The specimen, measuring 19 mm. in length, 10 mm. in width, and 5 mm. in thickness, agrees well with the previous descriptions. The flat cups lying in superficial layer of perisome are 40–76 $\mu$  in diameter, being much smaller than those described by v. Marenzeller and Théel.

*Habitat*.—Japan (v. Marenzeller, 1881; Théel, 1886); Mergui Archipelago (Pearson, 1910); Tokyo Bay (Mitsukuri, 1912); north of Kyushu.

##### 69. COLOCHIRUS DOLIOLUM (Pallas).

*Actinia doliolum* PALLAS, *Miscellanea zoologica*, 1766, p. 152, pl. 11, figs. 10–12.  
*Colochirus doliolum* v. MARENZELLER, *Kritik adriatischer Holothurien*, 1874, pp. 303–304.—MITSUKURI, Actinopodous Holothurioidea, 1912, pp. 218–221, pl. 1, figs. 10–11.  
*Colochirus australis* LUDWIG, *Beiträge zur Kenntniss der Holothurien*, 1874, pp. 12–13, pl. 6, figs. 15a–c.

- Colochirus minutus* LUDWIG, Beiträge zur Kenntniss der Holothurien, 1874, p. 13, pl. 6, figs. 16a-c.  
*Colochirus armatus* v. MARENZELLER, Neue Holothurien von Japan und China, 1881, pp. 132-134, pl. 5, figs. 8, 8Aa, b.  
*Colochirus australis*, var. *armatus* LUDWIG, Holothurien des Kieler Museums, 1883, p. 161.—AUGUSTIN, Japanische Seewalzen, 1908, p. 29.  
*Colochirus pygmaeus* THÉEL, Challenger Holothurioidea, pt. 2, 1886, p. 83, pl. 4, fig. 9.

Station 4895. One specimen.

Station 4935. One specimen.

*Habitat*.—Cape of Good Hope (Pallas, 1766); Angra Pequena (Ludwig, 1887); Cape Three Points (Clark, 1909). Triest (Sars, 1857); Quarnero (Grube, 1840); Lesina, Lissa (Heller, 1868); Cete and Nice (Selenka, 1867). Bahia (Théel, 1886). Bowen and Sydney (Ludwig, 1874); Port Molle and Port Jackson (Bell, 1884; Théel, 1886); New South Wales and West Australia (Lampert, 1885). Dampier Island (Lampert, 1889); Billiton (Sluiter, 1887); Amboina (Ludwig, 1888; Sluiter, 1894); Sarassa Island; Molo Strait; Salawatti; Jedan Island (Sluiter, 1901). Ceylon (Pearson, 1903); Tor, coast of Sinai (Helfer, 1912). Japan (v. Marenzeller, 1881); Tokyo Bay (Augustin, 1908; Mitsukuri, 1912); Misaki; Yokohama; Shimoda; Niishima; Ago Bay; Kagoshima; Hokkaido (Mitsukuri, 1912); off Goto Islands, west of Kyushu; off Cape Sata, South of Kyushu.

#### Genus THYONE Oken.

##### 70. THYONE MULTIPES Augustin.

*Thyone multipes* AUGUSTIN, Japanische Seewalzen, 1908, pp. 27-28, pl. 2, fig. 2, text-fig. 19.

Station 5055. Seven specimens.

Station 5057. Three specimens.

Station 5094. A pharyngeal mass with tentacles.

The largest specimen measures 28 mm. in length and 10 mm. in diameter. Deposits in general perisome are so sparse as to be easily overlooked. These are delicate table-like buttons with lozenge-shaped disk and two-pillared spire. The disk measures 33-85 $\mu$  in diameter, averaging 68 $\mu$ , with 4-13, but commonly 6 or 7 holes. Spire about 25 $\mu$  high, with the pillars connected by a crossbeam, and with 4-8 short teeth at the top. Towards the anal region the tables become smaller but have more holes. In the introvert the tables are larger and more robust, measuring 76-125 $\mu$  in diameter, with holes numbering up to 17, and the spire is 35-50 $\mu$  high. Very few complicated rosettes are also found in this region. Besides the 5 latticed anal teeth there are found several large round plates, 0.1-0.14 mm. in diameter, and with numerous holes, radially arranged around the anus. Pedicels with a well developed end-plate with the mean diameter of 96 $\mu$  (80-113 $\mu$ ), and perforated with numerous irregular



holes which are larger towards the periphery; no other supporting bodies are present. Stone-canal not very short, as stated by Augustin, measuring 5 mm. in length, with kidney-shaped madreporite.

Both *Th. venusta* Selenka and *Th. villosa* Semper are very closely allied to the present species. It would not be surprising if later examinations should prove these forms to be one and the same species.

*Habitat*.—Uraga Channel and Sagami Bay (Augustin, 1908); Suruga Bay.

71. THYONE PUNCTATA, new species.

Station 4936. One specimen.

Body more or less quadrangular, with both anterior and posterior ends bent dorsad. Length, 28 mm.; diameter, 6 mm. Color whitish, punctate with brownish pedicels, tentacles dark gray. Integument thick and stiff, rough to the touch, except on the well-marked introvert, which is quite soft. Tentacles 10, of which the 2 ventral are very small. Pedicels minute and retractile, uniformly scattered all over the body except in the posterior three-fourths of the ventrum, where they are confined to the 3 ambulacra, forming dense double rows. Introvert free from pedicels. The integument is stiffened with thickly crowded buttons similar in form to those found in *Th. similis* Ludwig.<sup>1</sup> Length of the disk ranges 135–210 $\mu$ , averaging about 165 $\mu$ . In the deeper parts are found larger ones with the diameter of 260 $\mu$  and with over 10 holes. In the introvert these are modified into smaller knobbed plates, 90–180 $\mu$  in diameter, with 5–16 holes. Pedicels are supported by bent modified tables, 140 $\mu$  long, with 4 holes at the middle and 1 at each dilated end. Supporting rods of tentacles are smooth, with several holes at each end. Anal teeth present. Calcareous ring well developed, with long posterior prolongations. Polian vesicle single. Respiratory trees two. Genital tubes unbranched.

From *Th. sacellus* (Selenka) which is also known from the coasts of Kyushu, the present species differs in size and shape of deposits and in the number of Polian vesicles. *Th. belli* and *Th. similis*, both described by Ludwig, are very close to the present species, especially the former in distribution of pedicels. But greater size of the button-shaped deposits distinguishes above all the new species.

*Habitat*.—Off Cape Sata, south of Kyushu.

*Type*.—Cat. No. 34171, U.S.N.M.

72. THYONE PARVA, new species.

Plate 10, fig. 23.

Station 5046 or 5047. One specimen.

Body plump, spindle-shaped, 9 mm. long and 5 mm. thick, with mouth and anus turned dorsad, more or less resembling *Sphærothuria*.

<sup>1</sup> See Ludwig, Vettor Pisani Holothurien, 1887, pl. 2, figs. 7A', A''.

Color white, integument rather soft, slightly rough to the touch. Pedicels densely distributed all over, especially numerous on ventrum, without any serial arrangement except in anal region. Anus is surrounded by 5 anal papillæ. Tentacles 10, midventral pair slightly smaller than the others. Perforated plates of various sizes forming a thick layer in general perisome. Those situated most superficially (pl. 10, fig. 23) are small and rod-like, usually with a hole at each end, and vary  $85-145\mu$  in length, averaging  $120\mu$ . In the deeper part are found larger, smooth plates,  $200-400\mu$  in diameter, with 15-20 or more holes. Pedicels often passing through a large hole in these plates. There are found all transitional forms between these two sorts of deposits. In the introvert are found scattered, elongated plates of various sizes, with larger holes. Supporting rods of tentacles irregular in form, with minute holes. In pedicels also similar perforated rods,  $90-210\mu$  long, are present. End plate well developed in ventral pedicels, measuring  $110-150\mu$  in diameter, rudimentary in dorsal pedicels, being only  $60-90\mu$ . Calcareous ring well developed but devoid of posterior prolongations. Retractors are inserted to body-wall a little anterior to the middle of body length. Polian vesicle and stone-canal single. Genital tubes not branched, few in number. Respiratory trees two.

*Th. spectabilis* Ludwig differs from the present species in that the rod-like deposits are thinly scattered and never give rise to perforated plates. *Th. articulata* Vaney also has similar deposits but differs in having long posterior prolongations in the calcareous ring. The species also resembles *Th. unisemita* (Stimpson), but differs in the uniform distribution of the ventral pedicels and in the presence of end plates.

*Habitat*.—Off Ojika Peninsula, Honshu.

*Type*.—Cat. No. 34172, U.S.N.M.

73. *THYONE BICORNIS*, new species.

Plate 10, figs. 24*a-d*.

Station 5074. Three specimens.

Body fusiform, tapering equally toward both ends; length, exclusive of introvert, 26 mm.; diameter, 11.5 mm. Color gray, with dark brown patches, which are especially abundant in interambulacra. Integument thin, soft and leathery, smooth to the touch. Pedicels very numerous, distributed all over the body, but arranged in a double row in each ambulacrum. Tentacles 10, midventral pair being considerably smaller than the rest. Rather sparsely scattered in general perisome are found table-like buttons (pl. 10, figs. 24*a, b*). The disk, which measures  $40-110\mu$  in diameter, with a mean of about  $70\mu$ , has four large primary holes and several peripheral ones, numbering from 2 to 16. Spire,  $25-35\mu$  high, consists of two pillars united

once or twice, ending in two diverging spines. Between them are found very rarely modified tables with 4-armed base, up to  $160\mu$  in diameter. Pedicels thorny in appearance, owing to the presence of numerous, long-spined buttons (figs. 24c, d). End plate small and rudimentary, with irregular contour. In the introvert are found complicated rosettes, oval in outline,  $40\mu$  long. Supporting rods of tentacles are characteristic and are of two principal forms. The slender, distal branches are supported by slender, smooth rods with some holes at each extremity, while in the thick, proximal parts, some are quite rod-like, but others are derived from complicated rosettes, resembling those found in *Echinocucumis adversaria* Semper.<sup>1</sup> There are all sorts of transitional forms between them. Calcareous ring resembles that of *Th. multipes*, but is more slender. Polian vesicle and stone-canal single. Retractors inserted at one-fourth the body length from the contracted anterior end. Respiratory trees well developed; genital tubes unbranched, numerous and slender.

In spite of its close resemblance to *Th. multipes* in external features the present species is characterized by the forms of its deposits in general perisome and tentacles. *Th. fusus* (Müller) and *Th. serratus* Britten differ from it in the shape of the buttons and end plate.

*Habitat*.—Suruga Bay.

*Type*.—Cat. No. 34173, U.S.N.M.

74. THYONE IMBRICATA, new species.

Station 5023. Four specimens.

Body a short spindle in shape, with mouth and anus directed dorsad. Length, as measured along ventral side, 34 mm.; along dorsal, 14 mm.; diameter, 8 mm. Color pure white from the presence of scale-like deposits which stiffen the integument. Tentacles 10, midventral pair being a little smaller than the rest. Pedicels uniformly scattered all over the body. Scale-like deposits are irregularly oval, with uneven margin, rather thick and complexly latticed; diameter, 0.3–1.2 mm. They are imbricating, but leave here and there narrow interspaces through which the pedicels pass outwards. Near the free margin of each scale stands a short, conical, spinous process projecting obliquely on the body surface, and measuring about 0.45 mm. in length. In the introvert are found scattered, elongated plates with holes and knobs, measuring 0.16–0.4 mm. in length. Pedicels supported by small rods with few holes; an irregular end plate, 0.10–0.17 mm. in diameter, is present. Tentacles richly supplied with supporting rods in the form of curved plates, 0.13–0.26 mm. in length. Calcareous ring well developed, with the posterior margin deeply indented but destitute of tail-like prolongations. Retractors

<sup>1</sup> See Ludwig, Vettor Pisani Holothurien, 1887, p. 24, pl. 1, fig. 3D.

inserted about 6 mm. from the anterior end. Polian vesicle and stone-canal single, the latter with a comparatively large madreporite. Respiratory trees two, well developed but with very few simple branches. Genital tubes simple and short, each with a single ovum, which measures at most 1.2 mm. in diameter.

This species is remarkable in that the female has a pair of brood pouches, which lie side by side on the ventral body wall and are lined with a thin, noncalcareous membrane, and open by a common orifice situated in the midventral radius, 10 mm. from the anterior end. In these pouches I found ova and young in three different stages of development—mature ova, young, 2 mm. long, and larger ones, 3 mm. or more in length. In one case there were 5 ova and 2 smaller young in the right pouch, and 2 ova, a small young and a larger one, in the other. These larger young seem to be ready for birth, with imbricating scales 300–350 $\mu$  in diameter, but devoid of marginal process. The presence or absence of pedicels can not be ascertained owing to the excessive development of scales. The smaller young have rather scattered plates, 180–240 $\mu$  in diameter, in body wall. Scattered spicules are also found in tentacles and stone-canal. Calcareous ring and coiled gut are already formed, but pedicels could not be made out.

This species belongs to the group distinguished by Studer as *Trachythyone*, but differs from his *muricata* in the shape of the scalelike deposits and in the absence of cup-shaped bodies.

*Habitat*.—Off Cape Terpyeniya, Sakhalin.

*Type*.—Cat. No. 34174, U.S.N.M.

#### Genus PSEUDOCUCUMIS Ludwig.

##### 75. PSEUDOCUCUMIS DACTYLICUS, new species.

Station 4913. One specimen.

Body fusiform, with oral and anal ends prolonged into dorsally curved, slender, tapering processes. Length as measured along mid-ventrum, 45 mm.; along middorsum, 28 mm.; diameter, 8 mm. Color white, due to large scalelike deposits, which stiffen the integument. Tentacles 15, seldom with a few knoblike rudiments of branches, otherwise simple and finger-shaped. Seven of them are long, about 2 mm.; 2 in the middorsal and right ventral interradii, only 1 in each of the other interradii. The remaining 8 are very short; 1 in the left dorsal and midventral radii and 2 in each of the other 3 radii. Pedicels very minute, arranged in two rows in each ambulacrum, passing through interspaces of scalelike deposits. Around the anus there are 5 papillæ. The scalelike deposits are round in contour with rather even margin, and perforated by large numbers of holes; they do not present complex, latticed, laminar structure, but are simply perforated plates; diameter, 0.45–1.20 mm. They lie imbricated in such a way that in an ideal cross section the free margin is

directed dorsad, and in longitudinal section toward either end of the body. The free margin bears a vertically directed, rudimentary, spiny process. In the introvert irregularly elongated plates with large holes and slight knobs are present; length, 130–270 $\mu$ , with a mean of 185 $\mu$ ; holes 4–39 in number, averaging 14. Supporting rods of tentacles are arched, narrow plates with several holes and serrated margin, measuring 0.1–0.2 mm. in length. Supporting rods of pedicels are rudimentary and sparse, with a few large holes. End plate, of irregular shape, 90–130 $\mu$  in diameter. It is very difficult to make out the true arrangement of the calcareous ring. Radial segments have 2 or 3 anterior processes, but no posterior prolongations. Some interradial segments seem to be composed of 2 triangular pieces. In general configuration the segments are very much like those of *Cucumaria inflexa* Kœhler and Vaney.<sup>1</sup> Polian vesicle and stone-canal single. Retractors inserted 5 mm. from the anterior end of body. Respiratory trees 2, simple, with rudimentary branches in the shape of globular vesicles. Genital tubes unbranched, in 2 tufts. The third limb of the alimentary canal runs along the left side of the odd ambulacrum.

This species is quite characteristic in the number, form, and relative sizes of its tentacles and in the asymmetry of the calcareous ring. It may be unnatural to refer it to the genus *Pseudocucumis*; probably a new genus should be formed to include this species and the closely allied *Cucumaria digitata* Kœhler and Vaney.

*Habitat*.—Off Koshiki Islands, west of Kyushu.

*Type*.—Cat. No. 34175, U.S.N.M.

76. PSEUDOCUCUMIS WATASEI, new species.

Plate 10, figs. 25a, b.

Station 5069. Eight specimens.

Body cylindrical or spindle-shaped, measuring 21 mm. in length, exclusive of the introvert, and 8 mm. in diameter. Color pale white to dirty brown; integument thin and somewhat stiff, slightly rough to the touch. Tentacles 20, of 3 different sizes. The largest 10, one pair to each interradius, alternate with 5 radially situated pairs, which are of 2 sizes. In the paired radii the smaller one is situated ventrally to the larger, and in the odd radius, at the left. Pedicels arranged regularly in 2 rows in each ambulacrum both in trivium and bivium, not crowded. Interambulacra totally devoid of pedicels. General perisome uniformly beset with numerous tables (pl. 10, figs. 25a, b). Disk round or slightly elliptic, with entire margin. Central hole large, usually with an X-shaped span on the underside (fig. 25b). Peripheral holes 8 in number normally, but may increase to 11. Spire consists of 2 converging pillars, united by a crossbeam and

<sup>1</sup> Les Holothuries littorales, 1908, pl. 2, fig. 9.

armed with a few apical teeth. Mean diameter of disks about  $90\mu$  ( $63$ – $126\mu$ ); height of spire  $40$ – $50\mu$ . Tables in the introvert are somewhat irregular in form but similar in size, with a disk pierced by numerous large holes. Five anal teeth present. Pedicels supported by modified tables with elongated disk and two-pillared spire; length of disks  $110$ – $120\mu$ , height of spire  $40$ – $60\mu$ . End plate well developed, measuring  $140$ – $185\mu$  in diameter. Supporting rods of tentacles irregularly branched and perforated. Calcareous ring resembles that of *Ps. africanus* (Semper), but lacks the posterior prolongations. Retractors inserted to body wall at about two-fifths the body length from the anterior end. Polian vesicle and stone-canal single, the latter ending in a fungiform madreporite. Respiratory trees 2, with a few simple branches. Genital tubes branched twice dichotomously, in 2 tufts.

The present species resembles *Ps. bicolumnatus* Dendy and Hindle in the form of its tables and calcareous ring, but differs from it in having tentacles of 3 different sizes, in the lesser crowding of the pedicels, and in the presence of an X-shaped spanning bar on the underside of the table disks. I take great pleasure in naming this new species for Prof. Shozaburo Watase, of Tokyo Imperial University.

*Habitat.*—Suruga Bay.

*Type.*—Cat. No. 34176, U.S.N.M.

77. PSEUDOCUCUMIS SAGAMIENSIS, new species.

Plate 10, figs. 26a, b.

Station 5088. One specimen.

Body spindle-like, with both extremities tapering and turning dorsad. Length, as measured along the ventral median line, 27 mm.; along the dorsal, 16 mm.; diameter, 6 mm. Color dirty brown all over; integument thin and stiff, rough to the touch. Only 14 tentacles are present, the small midventral one probably lost by accident. Ten of them are large and are situated interradially in pairs; the others are small and are radial in position. Pedicels nonretractile, arranged in two rows along each ambulacrum. Interambulacra naked, the middorsal interambulacrum being twice as broad as the others. General perisome thickly beset with tables (pl. 10, figs. 26a, b). Disk almost round,  $115$ – $250\mu$  in diameter, average  $190\mu$ , perforated with small holes, usually 13 in number, but varying from 7 to 22. Spire about  $100\mu$  high, consisting of two pillars united twice and ending with a few obtuse teeth. Tables in the introvert sparsely scattered,  $90$ – $140\mu$  in diameter, averaging  $110\mu$ , with holes 5–15 in number, averaging 8; height of spire  $50\mu$ . Pedicels supported by modified, elongated tables, about  $85\mu$  long. End plate not well developed. Supporting rods of tentacles fusiform, with 4 large holes in the middle and small ones irregularly

arranged at both ends. Anal teeth 5, in the shape of simple perforated plates. Calcareous ring without posterior prolongations, wavy in the posterior margin. The radial segment has two unequal incisions on its broader anterior margin, besides the deep, median notch. Interradials triangular in shape. Retractors inserted at about two-fifths the body length. Polian vesicles 2, stone-canal 1. Respiratory trees 2, opening into a long cloaca at its beginning. Genital tubes branched once or twice, in 2 tufts.

*Ps. discrepans* (Sluiter), the only 15-tentacled stichopoda hitherto known, differs from the present species in having tables with a 4-pillared spire and calcareous ring with posterior prolongations.

*Habitat*.—Sagami Sea.

*Type*.—Cat. No. 34177, U.S.N.M.

78. PSEUDOCUCUMIS TABULATUS, new species.

Plate 10, figs. 27a-c.

Station 4900. Two specimens.

Station 4904. One specimen.

Body fusiform and curved. Length, as measured along ventral median line, 26 mm.; along dorsal, 18 mm.; diameter, 8 mm. Color dirty grayish-brown; integument thin and stiff, rough to the touch. Tentacles 20, 5 very minute, radial in position, the other 15 apparently of uniform size. Pedicels nonretractile, arranged sparsely in 2 rows in each ambulacrum, numbering above 40 in trivium, and less than 30 in bivium. Three dorsal interambulacra have in their middle region a very few scattered pedicels. Deposits of general perisome are robust tables uniformly distributed (pl. 10, figs. 27a-c). Disk almost round, 90-185 $\mu$  in diameter, mean about 145 $\mu$ , perforated with small holes numbering 8-22, most commonly 12 or 13. Central hole very large, covered with an arched cross, on each arm of which stands a robust pillar forming together a conical spire. The pillars number usually 4, but may often increase up to 7. The spire is about 67 $\mu$  high, armed with a number of minute teeth (figs. 27a, b). The central hole of the disk is also covered over on the under side by an irregularly branched arch (figs. 27b, c). Tables of smaller size quite regular in shape, with a 4-pillared spire and 8 large peripheral holes arranged in a circle. Deposits of the introvert are scattered, elongated plates with many holes and serrated margin, measuring 30-150 $\mu$  in length. Anus surrounded by 5 anal teeth. Pedicels richly beset with modified tables with elongated disk and 4-pillared, toothed spire; length of tables, 97-180 $\mu$ . End plate well developed, measuring 175-225 $\mu$  in diameter. Supporting rods of tentacles smooth and curved, with several minute holes at the slightly expanded ends. Calcareous ring made up of 10 segments, each with a deep posterior notch, but without posterior prolongations. Retractors inserted

at one-fourth the length of body. Polian vesicle and stone-canal single, the latter ending in a folded madreporite. Respiratory trees 2, short, with a few branches. Genital tubes in the shape of vesicles, in 2 tufts.

This species is characterized by its robust tables. From *Ps. mixta* Östergren it differs in the shape of deposits and calcareous ring.

*Habitat*.—Off Goto Islands, west of Kyushu.

*Type*.—Cat. No. 34178, U.S.N.M.

### Genus AMPHICYCLUS Bell.

#### 79. AMPHICYCLUS JAPONICUS Bell.

*Amphicyclus japonicus* BELL, Studies in the Holothuroidea, vol. 3, 1884, pp. 253–254.—OHSHIMA, System of Phyllophorinæ, 1912, pp. 71–76, pl. 1, figs. 5, 6, text-figs. 2, 3a–o.

*Pseudocucumis japonicus* LUDWIG, Alte und neue Holothuriénarten, 1887, p. 1239.—AUGUSTIN, Japanische Seewalzen, 1908, p. 29.

Station 5069. Three specimens.

For a detailed account of this species, I refer to my former paper.

*Habitat*.—Tsugaru Strait (Bell, 1884); Uraga Channel (Augustin, 1908); Numa, Sagami Sea; Suruga Bay; Province Echizen ? (Ohshima, 1912).

### Genus PHYLLOPHORUS Grube.

#### 80. PHYLLOPHORUS CYLINDRICUS, new species.

Plate 11, figs. 28a, b.

Station 5021. One specimen.

Body long and cylindrical, of almost uniform diameter throughout, ending bluntly at both extremities, where the mouth and anus open. Length, 100 mm.; diameter, 13 mm. Color, gray all over. Integument thick, full of creases and slightly rough to the touch. Tentacles deep purplish-black in color; only 12 are present, of which 8 are large and 4 small. Pedicels contracted, distributed all over the body without any serial arrangement, except near the posterior end, where they form a double row in each ambulacrum. General perisome with rather scattered tables (pl. 11, figs. 28a, b). Disk irregular, with serrated contour, and 6–28 holes arranged in a circle or two concentric circles; disk diameter 130–225 $\mu$ , with a mean of 170 $\mu$ . Over the large central hole spans an arch with 4, very rarely 3 or 5, arms, on each of which stands a pillar. These pillars unite to form a spire which ends with an incomplete, toothed crown. Height of spire, 60–130 $\mu$ . Similar but more irregular tables are found in pedicels. End plate single, well developed, measuring 0.4–0.6 mm. in diameter. The introvert tables have delicate disk, measuring 150–260 $\mu$ , and with an imperfect spire. Toward the base of the tentacles these tables gradually give place through many interme-



diate forms to elongated, spinose plates, 320–640 $\mu$  long. Tentacles supported by rodlike, spinous plates, up to 680 $\mu$  in length. Anal papillæ and teeth present. Calcareous ring consists of 10 narrow segments, 9 mm. long and 3 mm. wide, each with a deep posterior indentation, but no prolongations. The anterior margin of radial segments is divided into 2 unequal halves. Retractors inserted to body wall at different levels; the midventral one 16 mm., the dorsal ones 23 mm., from the anterior end of body. Polian vesicle and stone-canal single. Genital tubes unbranched. Respiratory trees 2, each consisting of a thick stem and 2 rows of side branches.

This species is characterized by its cylindrical, *Synapta*-like body and the narrow segments of its calcareous ring. Judging from the shape of the calcareous ring, the normal number of tentacles is probably 15, and *Orcula luminosa* Lampert is very close to it. Though *O. barthii* Troschel has been reported as being destitute of deposits, the tables figured by Kalischewskij<sup>1</sup> resemble those of the new species.

*Habitat*.—Off Cape Terpyeniya, Sakhalin.

*Type*.—Cat. No. 34179, U.S.N.M.

81. PHYLLOPHORUS GLAUCUS, new species.

Plate 11, figs. 29a–c.

Station 4782. One specimen.

Body fusiform, much tapering toward the posterior end. Length 40 mm., including the well defined introvert of 3.5 mm.; diameter, 13.5 mm. Integument transversely wrinkled, rough to the touch. Color purplish-gray, with tips of pedicels colored blackish-purple. Tentacles 15, of 2 different sizes. Ten are large, situated interradially in pairs; the other 5 are small, radial in position, and form an inner circle. Pedicels nonretractile, arranged in more or less conspicuous rows all over the body with the exception of the introvert; much more crowded in trivium than in bivium, where they form distinct double rows in the radii. General perisome and pedicels stiffened with numerous tables (pl. 11, figs. 29a–c). They resemble those found in *Pseudocucumis tabulatus*, with round disk and robust spire. Mean diameter of disks, 130 $\mu$ ; range, 90–185 $\mu$ ; peripheral holes usually in a single circle, numbering 9–25. Spire consists of 4–7 pillars, 55–75 $\mu$  high, ending with numerous apical spines. On the under side of the disk an irregularly branched arch covers the large central hole (fig. 29c). Tables in the introvert are almost of the same size as the foregoing, but the margin of disk is serrated or spinose. Five anal teeth present. Tables in pedicels are similar to general perisome, only smaller, averaging 100 $\mu$  in diameter. End plate well developed, 350–400 $\mu$  in diameter. Scattered in dorsal perisome are found small end plates, measuring 90–160 $\mu$  in diameter, representing rudimentary

<sup>1</sup> Echinodermenfauna d. sibir. Eismeeres, 1907, pl. 1, figs. 4b, c.

pedicels. Tentacles are supported by oval or elongated, knobbed plates up to 0.5 mm. in length. Radial segments of calcareous ring without posterior prolongations, with the anterior margin divided into unequal halves. Retractors inserted to the body wall less than one-third of the body length, from the anterior end. Polian vesicle and stone-canal single. Genital tubes dichotomously branched near the base, forming 2 tufts. Respiratory trees 2, with pinnate branches.

*Orcula luminosa* Lampert is very close to the present species, only differing in the smaller number of large, plump tables in the perisome and the absence of tables from the pedicels.

*Habitat*.—Aleutian Islands.

*Type*.—Cat. No. 34180, U.S.N.M.

82. PHYLLOPHORUS DIOMEDEÆ, new species.

Plate 11, figs. 30a, b.

Station 4994. Three specimens.

Station 5046 or 5047. One specimen.

Body fusiform, gradually tapering posteriorly, 36.5 mm. long, 9 mm. across. Integument soft, rough to the touch, white to yellowish-brown in color. Tentacles gray in color, 15 in number, of which 10 are large and interradial in position, while the other 5 are very minute and lie one in each radius. Pedicels small and short, forming a double row in each ambulacrum, and irregularly scattered in all interambulacral spaces. Deposits of general perisome are tables (pl. 11, figs. 30a, b); disk nearly quadrangular, with wavy margin, a large central hole and 4–20 peripheral ones. Diameter of disks 83–160 $\mu$ , with a mean of about 105 $\mu$ . Spire, 50–80 $\mu$  high, made up of 4 pillars, connected twice by crossbeams and ending with numerous, minute teeth. Tables in the introvert are very irregular, with serrated margin and numerous holes, equal in size to those of general perisome; spire is often totally absent, or very rarely composed of 5 pillars. Pedicels have tables like those in perisome and an end plate measuring 110–300 $\mu$  in diameter. Anus surrounded by 5 teeth and 10 papillæ. Supporting rods of tentacles usually widened at the middle, without knobs and perforated by a few holes. Each radial segment of calcareous ring is divided at its anterior margin into 2 unequal halves. Retractors inserted less than one-fourth of the body length from the anterior end. One or two Polian vesicles, one stone-canal. Respiratory trees 2, opening at the anterior end of the long cloaca.

The species resembles my *Ph. cylindricus*, but differs in the general shape of its body and in the shape and size of its tables. These are similar to those of *Orcula tenera* Ludwig, but they seem to be very sparse in that species and moreover the calcareous ring has long posterior prolongations.

*Habitat*.—Off Rebun Island, Hokkaido; off Ojika Peninsula.

*Type*.—Cat. No. 34181, U.S.N.M.

## 83. PHYLLOPHORUS MINUTUS, new species.

Plate 11, figs. 31a, b.

Station 4900. Two specimens.

Body indistinctly pentangular, with bluntly ending extremities, 13.5 mm. in length and 5 mm. in diameter. Integument thin and soft, smooth to the touch, white all over. Tentacles 20, of 2 different sizes; 10 interradial larger than the 10 radial, which form an inner circle. Pedicels retractile, forming a zigzag or double row along each ambulacrum. Very minute pedicels invisible to the naked eye scattered in the three dorsal interambulacra. Deposits of general perisome are table-like buttons, quite regular in shape (pl. 11, figs. 31a, b); disk quadrangular or rhombic, with large holes numbering from 4 to 10, usually 8; mean diameter of disks about  $83\mu$ , range  $60-120\mu$ . From the central bar, which separates the 2 pairs of largest holes, arise a pair of pillars which unite once and give off 4-8 short teeth at the top. Height of spire,  $20-27\mu$ . In the introvert the tables are slightly smaller,  $45-100\mu$ , often irregular and rod-like in shape. In pedicels are found much robust and elongated tables with 2 pairs of holes at the middle and a few at each end. The two prolongations of the disk often do not lie in a straight line as in *Ph. alexandri* (Fisher). End plates of pedicels larger in the ambulacra, measuring  $220-280\mu$  in diameter, in the interambulacra only  $100-200\mu$ ; single small end plates often representing rudimentary pedicels. Supporting rods of tentacles smooth, with expanded or branched ends perforated by minute holes. Anus with 5 teeth and 10 papillæ. Calcareous ring similar to that of *Ph. intermedius* Kœhler and Vaney, only differing in that the anterior margin is not oblique and in that the segments are united together by one-half of their length. Retractors inserted to body wall slightly behind the middle of body, the midventral one being most anterior. Polian vesicle and stone-canal single. Genital tubes apparently immature, unbranched, few in number. Respiratory trees 2.

This species stands very close to *Ph. intermedius* in many respects, but differs from it in the shape of the calcareous ring and deposits. *Ph. alexandri* from Hawaii is also very nearly allied to the present species, but differs by the presence of numerous pedicels in the dorsal interambulacra, besides having calcareous ring and tables of different shapes.

*Habitat*.—Off Goto Islands, west of Kyushu.

*Type*.—Cat. No. 34182, U.S.N.M.

## Genus PSOLUS Oken.

## 84. PSOLUS SQUAMATUS (Koren).

*Cuvieria squamata* KOREN, Nyt Magazin for Naturvidenskaberne, vol. 4, 1844, pp. 211-225, pls. 2, 3.

*Psolus squamatus* LUDWIG, Arktische und subarktische Holothurien, 1900, pp. 158-159.—ÖSTERGREN, Holothurioidea of Northern Norway, 1902, pp. 10-11.—VANEY, Expédition antarctique Française, 1907, pp. 27-28.—MITSUKURI, Actinopodous Holothurioidea, 1912, pp. 225-227, pl. 7, figs. 61-62, text-fig. 42.

*Psolus asper* AUGUSTIN, Japanische Seewalzen, 1908, pp. 30-31, pl. 2, fig. 4, text-fig. 20.

Station 5017. One specimen.

Station 5032. Seven specimens.

Station 5033. One specimen.

According to Östergren the specimens referred to this species by Bell (1882), Pfeffer (1890), Sluiter (1895), and Bidentkap (1899) belong to other species. According to Vaney, the name *Ps. squamatus*, var. *segregatus*, in Mitsukuri's list of synonyms should also be canceled. I think that Augustin's *Ps. asper* from Sagami Sea should probably be referred to this widespread and rather variable species.

*Habitat*.—Various localities in the North Atlantic (see Ludwig, 1900); Pacific coast of Chile (Théel, 1886); California and Lower California (Clark, 1901, 1913); Kuriles (Jæger, 1833); Sagami Sea (Augustin, 1908; Mitsukuri, 1912); east coast of Southern Sakhalin; Nemuro Strait, Hokkaido.

## 85. PSOLUS CHITONOIDES Clark.

*Psolus chitonoides* CLARK, Echinoderms from Puget Sound, 1901, pp. 335-337, pl. 3, figs. 5, 6; pl. 4, figs. 6-10.

*Psolus californicus* FISHER, Zool. Anz., vol. 29, No. 18, 1905, pp. 573-576, text-figs. 1-13.

Station 4784. Three specimens.

Station 4790. Two specimens.

The largest specimen is 60 mm. long, 47 mm. wide, and 26 mm. thick. In the middle part of the odd ambulacrum a few scattered pedicels are present, but only in large individuals. The characteristic plates in the sole measure 100-310 $\mu$  in diameter, with holes numbering above 20. End plate of pedicels is single in young individuals but becomes multiple in older ones. Of the triangular scales around the mouth the interradiial 5 are larger, the inequality being more emphasized in the young. There are about 7 scales between the mouth and the anus, 20-22 in a transverse line where the body is broadest. The specimens before me agree with those of *Ps. californicus* in almost every point, but differ by the presence of a complete series of midventral pedicels in the latter. This again seems to be referable to *Ps. chitonoides*, though the latter is rather briefly described and shows some slight differences.

*Habitat*.—Puget Sound (Clark, 1901); Monterey Bay, California (Fisher, 1905); Aleutian Islands.

86. (?) *PSOLUS JAPONICUS* Östergren.

*Psolus japonicus* ÖSTERGREN, Zur Anatomie der Dendrochiroten, 1898, pp. 135-136.—BRITTEN, Holothurien a. d. japan. u. ochotsk. Meere, 1907, pp. 146-147.—OHSHIMA, Zool. Mag. (Japanese), vol. 25, No. 293, pp. 130-132, pl. 5, figs. 1-9.

Station 4807. Two specimens.

Station 4808. Two specimens.

The largest specimen measures 40 mm. long, 32 mm. wide, and 10 mm. thick. Deposits of sole in a single layer, only 100-280 $\mu$  in diameter; differing from those of *Ps. squamatus* in that the solid interspaces are broader than apertures and that knobs extend to form a second layer. There are 10-11 scales between the mouth and the anus, 20-30 in a transverse line at the broadest part of the body.

My identification may be criticized. The specimens differ from those described by Östergren and Britten, first, in that the dorsal scales are thin and numerous; second, in the absence of large plates 0.4 mm. wide; and third, in the occasional presence of some scattered pedicels in the odd ambulacrum. They can not be referred to any other known species.

*Habitat*.—Tsugaru Strait (Östergren, 1898); west coast of southern Sakhalin (Britten, 1907).

Genus *PSOLIDIUM* Ludwig.87. *PSOLIDIUM VITREUM*, new species.

Plate 11, fig. 32.

Station 4979. One specimen.

Station 5084. Three specimens.

Station 5087. Five specimens.

Body as seen from dorsum elliptic, with a strongly vaulted dorsum and a concave ventrum very sharply distinguishable from the other parts. Mouth anterodorsal, anus decidedly dorsal, both borne on a low, conical prominence. Young individuals are quite flat. As measured in the largest specimen, sole is 21 mm. long and 14 mm. wide; distance from mouth to anus, 20 mm.; height of body about 9 mm. Color white and glassy all over, ventral sole very thin and semi-transparent. Tentacles 10, midventral pair being smaller than the rest. Pedicels nonretractile, arranged in a zigzag row in each ventrolateral ambulacrum, just on the edge of the sole. The odd ambulacrum has only a very few, sparsely scattered pedicels. Minute papilla-like pedicels are sparsely scattered all over the dorsum. They are 350 $\mu$  long and 100 $\mu$  across. Deposits of sole are round or oval plates often overlapping one another (pl. 11, fig. 32); holes large, quite regularly arranged, 6.5-53 $\mu$  across, average 25 $\mu$ , smaller or often obliterated in old individuals. At each node of the

mesh is a round knob, which gives rise very rarely in young individuals to an irregular network over the original plate, but becomes inconspicuous in old ones. Mean diameter of plates and number of holes increase with age. In the largest specimen these plates may measure  $400\mu$  in diameter and have 36 holes. Dorsal scales thin, smooth, round in outline, lying imbricated upon one another. Except those lying quite near the ventral margin, they show no considerable differences in size, being 1.0–1.5 mm., and only rarely 2.5 mm., in diameter. Some of these scales may have a hole, through which the dorsal pedicel is given out. Around the mouth and the anus the scales are triangular in shape and show no regular arrangement. In the largest specimen there are 27 scales between the mouth and the anus and 30 in a transverse line at the widest part of the body. Between the anterior margin of the sole and the mouth there are 10, between the anus and the posterior margin of the sole, 12. Ventral pedicels have arched, elongated plates with two rows of holes, and an end plate measuring  $150\text{--}180\mu$  in diameter. Pedicels of dorsum have simple supporting rods and a small end plate. Supporting-rods of tentacles are similar to those of pedicels but broader and have more holes. Calcareous ring consists of 10 slender segments with no posterior prolongations. The ventral interradials are closely pressed on to the midventral radial segment. Polian vesicle and stone canal single. Genital tubes numerous and undivided. Respiratory trees 2, weakly developed.

In the form of the body and the arrangement of the ventrolateral pedicels the present species resembles *Ps. dorsipes* Ludwig, but differs from it in the following points: First, dorsal pedicels few and inconspicuous, each passing through a pore in the scale; second, deposits of sole of only one kind; and, third, pedicels very few along the odd ambulacrum. The specimen described by Théel as *Psolus* sp. (?) (*Blake Holothurioidea*, 1886, pp. 15, 16) seems to be a young of an allied species. *Psolus incertus* Théel is also very near to this species.

*Habitat*.—South of Totomi; Sagami Sea.

*Type*.—Cat. No. 34183, U.S.N.M.

88. *PSOLIDIUM BULLATUM*, new species.

Plate 11, fig. 33.

Station 4779. One specimen.

Body oval in dorsal aspect, dorsum vaulted, ventrum concave. Mouth and anus dorsal. Sole 12.5 mm. long and 10.5 mm. broad; thickness of body, 3.5 mm.; distance from mouth to anus, 11 mm. Color white all over, with rather coarse granules on the dorsal scales. In external appearance the animal very much resembles *Psolus fabricii* (Düben and Koren). Tentacles 10, midventral pair slightly

smaller than the others. Pedicels form 2 rows along the margin of sole, the inner row being very conspicuous, consisting of larger pedicels arranged alternately. The odd ambulacrum has at both ends some pedicels arranged in a double row, while in the middle part only a very few, weakly developed ones are present. Dorsal pedicels very minute, 80–150 $\mu$  in diameter. Deposits of sole are heavy, knobbed plates, often overlapping one another (pl. 11, fig. 33). They range 90–260 $\mu$  in diameter, with a mean of about 150 $\mu$ ; holes usually 8 or 9 in number, varying 1–33. Diameter of holes averages 20 $\mu$ , ranging 7–38 $\mu$ . Pedicels and tentacles with numerous arched plates without knobs. End plate of ventral pedicels 270–300 $\mu$  in diameter. In dorsal pedicels are found rudimentary end plate and supporting plates. Dorsal scales are rather uniform in size, up to 1.2 mm. in diameter, imbricating, with large granules measuring 150–200 $\mu$  across. There are about 17 scales between the mouth and the anus, 25 in a transverse line where the body is widest, 7 in front of mouth, and 9 behind anus. No enlarged or regularly arranged scales around the mouth and anus. Dorsal pedicels mostly passing through a pore or pores in a scale, there being often three or more of these pores in a single scale. Calcareous ring with no posterior prolongations. Polian vesicle and stone-canal single. Genital tubes unbranched. Respiratory trees two, tolerably developed.

*Ps. disjunctum* Sluiter differs from this species in the shape of its deposits in the sole and the distribution of its dorsal pedicels. *Ps. rugosum* K  hler and Vaney is also closely related to the present species, but differs by the greater number of its scales, a richer development of the granules on the latter, and the smaller number of its midventral pedicels.

*Habitat*.—Aleutian Islands.

*Type*.—Cat. No. 34184, U.S.N.M.

#### Family SYNAPTIDÆ Burmeister.

#### Genus PROTANKYRA   stergren.

#### 89. PROTANKYRA KAGOSHIMENSIS, new species.

Plate 11, figs. 34a–c.

Station 4945. Nine fragments.

Length over 125 mm., diameter up to 15 mm. Color reddish-brown with a tinge of green. Integument transversely wrinkled, sticky from the presence of large anchors. Tentacles 12, each with 2 pairs of digits, of which the terminal ones are larger. The anchor (pl. 11, fig. 34a) is large and slender, with the stock divided in the shape of a T, its surface being finely serrulate. The top is smooth, but each arm has on its middle part about a dozen teeth. Length of anchors ranges

410–980 $\mu$ , with a mean of 740 $\mu$ , span breadth of arms 270–610 $\mu$ , with a mean of 470 $\mu$ . The anchor plate (fig. 34*b*) is oval, with a transverse ridge near its narrowed hinge end. Holes are very numerous, each lined with fine teeth; they are small and regular in the central part but large and irregular toward the periphery. Length of anchor plates 320–840 $\mu$ , with a mean of 605 $\mu$ , breadth 260–620 $\mu$ , with a mean of 490 $\mu$ . Anchors and anchor plates are small in the anterior region. Miliary granules are of the form of curved rods or parentheses (fig. 34*c*), measuring 20–60 $\mu$  in length. These are especially clustered on low round prominences, measuring 160 $\mu$  across and sparsely scattered on the skin. In digits of tentacles they are more slender and 40–90 $\mu$  long, with short branches at each end. In the radial muscles and the deeper part of the wall of the tentacles are found very plump, oval or sausage-shaped granules. Calcareous ring 2 mm. high, with a stone canal and 7 Polian vesicles attached to it. Muscles well developed, the radial bands measuring 5.5 mm. in breadth. Next to the esophagus the alimentary canal presents a spherical dilation, 6 mm. in diameter, followed by a muscular stomach, 30 mm. long and 2.5 mm. thick. Genital tubes branched once or twice. Ciliated funnels not very numerous, found in the left dorsal interradius.

*P. insolens* (Th  el) is doubtless very akin to this new species, but differs by the form of its miliary granules and by the holes of the anchor plates being larger toward the center. The species also very much resembles *P. benedeni* (Ludwig) and *P. denticulata* K  hler and Vaney, differing only in the shape of the deposits.

*Habitat*.—Kagoshima Bay, Kyushu.

*Type*.—Cat. No. 34185, U.S.N.M.

#### Genus ANAPTA Semper.

##### 90. ANAPTA (?), species.

Station 5080. One specimen.

The specimen lacks its posterior part, measuring only 20 mm. in length and 6 mm. in diameter. Color dirty gray. Tentacles 12, with 7 digits. Deposits totally absent, probably dissolved by the action of acid. Calcareous ring very weak, embedded in a connective tissue. Viscera all ejected.

*Habitat*.—Off south of Izu Peninsula.

#### Genus CHIRIDOTA Eschscholtz.

##### 91. CHIRIDOTA ALBATROSSII Edwards.

*Chiridota albatrossii* EDWARDS, *Albatross Holothurians*, 1907, pp. 50–52, text-figs. 1*a-c*, 2*d-f*, 3.

Station 4993. One fragment.

Station 4994. Ten fragments.



- Station 5006. Ten fragments.  
 Station 5007. Ten fragments.  
 Station 5008. Eight fragments.  
 Station 5009. Two fragments.  
 Station 5018. Two complete specimens and five fragments.  
 Station 5020. Two complete specimens and two fragments.  
 Station 5021. Two complete specimens and two fragments.  
 Station 5022. Four fragments.  
 Station 5023. Eight fragments.  
 Station 5026. Three fragments.  
 Station 5029. One fragment.  
 Station 5032. One fragment.  
 Station 5033. One complete specimen and six fragments.  
 Station 5043. Nine fragments.  
 Station 5044. One complete specimen and four fragments.  
 Station 5045. One fragment.

The largest specimen measures 235 mm. in length and 14 mm. in diameter. Tentacles normally 12, but exceptionally 10, each carrying 5-7, or even 9, pairs of digits. Wheel papillæ up to 2 mm. in diameter, forming a single row in the 3 dorsal interambulacra, but often confined to the middorsal one only. Wheels vary in diameter between 80 and 200 $\mu$ , with a mean of 145 $\mu$ . Spokes vary exceptionally from 4 to 9 in number. Very often there is a small triangular pore at the center, in place of the "Mittelpfeiler." The irregular branching rods measure 90-200 $\mu$  in length, and may be totally absent in some individuals. Polian vesicles 20 in number in one specimen.

The original specimens are described by Edwards as having much smaller wheels and rods than in those before me. There is, however, no doubt as to their specific identity.

*Habitat.*—Queen Charlotte Sound, off Fort Rupert, Vancouver Island, British Columbia; Boca de Quadra, vicinity of Naha Bay, Behm Canal, and junction of Clarence Strait and Behm Canal, southeast Alaska (Edwards, 1907); off Cape Terpyeniya and south ends of Sakhalin; off Rebus Island; Nemuro Strait; and off Hitaka, Hokkaido.

92. *CHIRIDOTA DISCOLOR* Eschscholtz.

*Chiridota discolor* ESCHSCHOLTZ, Zoologischer Atlas, 1829, pp. 12-13, pl. 10, fig. 2.—

CLARK, The Apodous Holothurians, 1907, pp. 26-28, 120.

*Liosoma sitchæense* BRANDT, Prodrömus, 1835, p. 58.

Unalaska. Five specimens.

Nikolski, Umnak Island. Three specimens.

The largest specimen is 37 mm. long and 7 mm. across. Integument soft and muscular, gray in color with minute, reddish pigment spots. Tentacles 12, digits 4-5 pairs. Deposits, wheels only; wheel papillæ in both dorsal and ventral interambulacra. Diameter of

wheels 50–105 $\mu$ , with a mean of 82 $\mu$ . Polian vesicles 7 in one specimen. Genital tubes once or twice branched. Ciliated funnels especially numerous in the left dorsal interambulacrum.

It is with much hesitation that I refer the specimens to this species, depending mainly on the fact that they are from the shores of Aleutian Islands, which are known as its home. Compared with the specimens of *Ch. lævis* (Fabricius) from Eastport, Maine, the specimens before me differ in the absence of branched rods from the tentacles.

*Habitat*.—See Clark, 1907, pages 27, 120.

### Genus TÆNIOGYRUS Semper.

#### 93. TÆNIOGYRUS CIDARIDIS, new species.

Station 4900. Nine specimens.

Body irregularly distorted, measuring at most 30 mm. long and 3.5 mm. in diameter. Two of them were found attached to a disk-bearing spine of *Cidaris* (*Goniocidaris*) *clypeata* Döderlein by their coiled posterior parts. Color white, skin rough to the touch. Tentacles 10, with 4–5 pairs of digits. Wheel-papillæ numerous on the dorsal side, probably totally absent from the ventral interambulacra except in the anterior part. Wheels are of the ordinary shape, measuring 30–135 $\mu$  in diameter, increasing in size towards periphery of the papilla. Hooks 120–185 $\mu$  long, 154 $\mu$  on an average, not gathered into hook-papillæ, but scattered in the perisome and more numerous in the ventrum than in the dorsum. Supporting rods of tentacles are smooth, slightly thickened at the middle part, and with short bifurcations at each end. Calcareous ring composed of 10 segments. Polian vesicle and stone-canal single. Genital tubes once or twice branched. Ciliated funnels could not be made out.

Though resembling *T. contortus* (Ludwig) in many respects, this species differs by the number of its tentacles and Polian vesicles. From both *T. australianus* (Stimpson) and *Trochodota dunedinensis* (Parker) it differs by the distribution of its deposits. *T. allani* Joshua differs from it in having much larger wheels and in the shape of its tentacle rods.

*Habitat*.—Off Goto Islands, west of Kyushu.

*Type*.—Cat. No. 34186, U.S.N.M.

### Genus TOXODORA Verrill.

#### 94. TOXODORA PACIFICA, new species.

Plate 11, fig. 35.

Station 5073. One complete specimen and three fragments.

Body cylindrical and long, 145 mm. in length and 14 mm. in diameter. Color purplish-gray all over, but very light in distended parts, where the body wall is thin and translucent. Tentacles 12 in number, each provided at the top with 3 pairs of digits of equal size. Deposits of only one kind, in the shape of parentheses, often with a little knot

at the middle (pl. 11, fig. 35); length 370–665 $\mu$ , with a mean of 517 $\mu$ . These are uniformly scattered in the general perisome as well as in the walls of the tentacles and their digits. Calcareous ring consists of 10 segments, 1.2 mm. high. Polian vesicles 6, stone-canal single and coiled in its course. Genital tubes once or twice branched near base. Genital papilla situated in the middorsal interradius, close behind the tentacular crown. Ciliated funnels few, scattered along the mid-dorsal line and the left dorsal interradius.

This genus has been represented by a single species, *T. ferruginea* Verrill of the Atlantic, from which the present one differs by its much greater size and the small number of tentacle digits.

*Habitat*.—Suruga Bay.

*Type*.—Cat. No. 34187, U.S.N.M.

### Genus MYRIOTROCHUS Steenstrup.

#### 95. MYRIOTROCHUS RINKII Steenstrup.

*Myriotrochus rinkii* STEENSTRUP, Videnskabelige Meddelelser fra den naturhistoriske Forening, 1851, pp. 55–60, pl. 3, figs. 7–10.—THÉEL, Note sur quelques Holothuries, 1877, pp. 3–11, pl. 1, figs. 1–13.—DANIELSSEN and KOREN, Holothurioidea, 1882, pp. 28–31, 79, 81, pl. 5, figs. 1–4; pl. 13, fig. 1.—LUDWIG, Über die Rädchen der Synaptiden, 1892, pp. 358–360, pl. 16, figs. 12–14; Arktische und subarktische Holothurien, 1900, pp. 166–167.—NORMAN, Natural History of East Finmark, 1903, pp. 415–417, pl. 27, figs. 5–9.—KALISCHESKIJ, Echinodermenfauna d. sibir. Eismeeres, 1907, pp. 9–11.—CLARK, The Apodous Holothurians, 1907, pp. 30–31, 128, pl. 8, figs. 21–22.

*Chirodota brevis* HUXLEY, Journal of Penny's Voyage, 1852, pp. 221–222.

*Myriotrochus brevis* DANIELSSEN and KOREN, Holothurioidea, 1882, pp. 31–35, 79–80, 81, pl. 5, figs. 5–7.

Station 4798. Fifty-one specimens, of which 37 are complete.

The largest individual measures 32 mm. in length and 8 mm. in diameter. Diameter of wheels, 160–250 $\mu$ ; number of spokes, 15–21; that of inward processes, 19–25.

*Habitat in the North Pacific*.—Lorenz Bay and Plover Bay (Ludwig, 1886); near Pribilof Islands (Clark, 1907); west coast of Kamchatka. The limits of distribution recorded by Ludwig (1900) have recently been widened by Kalischewskij (1907) and Clark (1907), to the east up to Bennett Island, longitude 147° 27' E., and to the south, off the banks of Newfoundland, latitude 45° 35' N.

#### 96. MYRIOTROCHUS MITSUKURII, new species.

Plate 11, fig. 36.

Station 4983. Two complete specimens and three fragments.

Station 4984. Two specimens.

Station 4985. One specimen.

Station 4988. One specimen.

Body cylindrical, 35 mm. long and 8 mm. across. Integument soft and muscular, smooth to the touch, white and translucent.

Tentacles short, 12 in number, with about 8 pairs of minute digits around the external, flattened surface; tips of digits tinged with brown. Deposits of general perisome sparsely scattered, except on the ventral side; they are wheels much resembling those of *M. rinkii* except in their larger size, the greater number of the inward processes and in the latter being slightly shorter. Diameter of wheels 215–365 $\mu$ , with a mean of 282 $\mu$ . Spokes 12–21 in number, averaging 17; inward processes 22–33, averaging 27. In tentacles are found very characteristic deposits which remind one of the *Acanthotrochus* wheel (pl. 11, fig. 36). They vary very much in size as well as in shape. Nave is solid, very often with a minute knob or so-called "stalk," or sometimes a stellate figure, at the center; spokes not bent and all in one plane; felly with short teeth on its internal and external sides, usually more numerous than the spokes; both the internal and external teeth are often inconspicuous or may be totally absent. Diameter of these wheels, including the outward processes, 55–205 $\mu$ ; number of spokes, 8–21; that of the outward processes, 19–27. Calcareous ring very stout, consisting of 10 segments, which measure 1.5 mm. in breadth, and with one or two spines anteriorly. Polian vesicle and stone-canal single, the latter with calcareous network in its wall. Genital tubes divided, in two tufts, immediately behind the calcareous ring. No ciliated funnels.

This species differs from all others of the genus in having the characteristic spinous wheels in the tentacles. *Acanthotrochus mirabilis* Danielssen and Koren differs from this species in having in the general perisome large spinous wheels with 8 spokes and wing-like expansions to each spoke. The new species is named in honor of the late Prof. Kakichi Mitsukuri, to whom the advancement of our knowledge of Japanese holothurians is in a large measure due.

*Habitat*.—Off the coast of Shiribeshi, Hokkaido.

*Type*.—Cat. No. 34188, U.S.N.M.

EXPLANATION OF PLATES.

(All figures are drawn by the author.)

PLATE 8.

Fig. 1. *Synallactes multivesiculatus*, new species.

*a.* Triradiate tablelike deposit from ventrum, side view. *b.* Same with disklike base, seen from above. *c.* Ordinary type seen from above.  $\times 200$ .

Fig. 2. *Synallactes gilberti*, new species.

*a.* Quadriradiate tablelike deposit from dorsum, seen from above. *b.* Same from ventrum, side view.  $\times 300$ .

Fig. 3. *Bathyploetes østergreni*, new species.

*a.* Quadriradiate tablelike deposit from base of dorsal papilla, seen from above. *b.* Same seen from side. *c.* Same from ventrum, seen from above. *d.* Same seen from side.  $\times 300$ .

Fig. 4. *Mesothuria media*, new species.

*a.* Table from dorsum, side view. *b.* Same seen from above.  $\times 300$ .

Fig. 5. *Pseudostichopus aleutianus*, new species.

*a.* Deposit from wall of genital tube. *b.* Same from perianal region, X-shaped type. *c.* Same, rod-like type.  $\times 300$ .

Fig. 6. *Pseudostichopus molpadioides*, new species.

*a, b.* Supporting rods of pedicel.  $\times 300$ . *c.* Deposit from perianal region.  $\times 150$ .

Fig. 7. *Pseudostichopus unguiculatus*, new species.

*a, b.* Spicules from wall of genital tubes. *c.* Supporting rod of dorsal papilla.  $\times 300$ .

Fig. 8. *Pannychia moseleyi virgulifera*, new subspecies.

*a.* Rod from ventrum, commonest type. *b.* Same, smooth type.  $\times 150$ .

Fig. 9. *Ilyodæmon miurense*, new species.

*a.* Large wheel.  $\times 200$ . *b.* Small wheel. *c.* Complicated rosette.  $\times 300$ .

PLATE 9.

Fig. 10. *Peniagone japonica*, new species.

Large X-shaped spicule from deeper part of dorsal perisome.  $\times 150$ .

Fig. 11. *Achlyonice monactinica*, new species.

*a.* Spicule from wall of genital tube. *b.* Triradiate spicule from ventrum. *c.* Commonest spicule from ventrum.  $\times 300$ .

Fig. 12. *Benthodytes gotoi*, new species.

Spicule with anchor-shaped spire from papilla.  $\times 100$ .

Fig. 13. *Stichopus nigripunctatus* Augustin.

- a. Table with large, entire disk and tall spire, from a young individual, side view.  
b. Same, from above.  $\times 300$ .

Fig. 14. *Molpadia clarki*, new species.

- a. Table with excentric disk, from side. b. Same, from above. c. Elongated table from tail.  $\times 120$ .

Fig. 15. *Molpadia infesta*, new species.

- a. Table from general perisome. b. Rhombic plate from tail.  $\times 100$ .

Fig. 16. *Capheira mollis*, new species.

- a. Table seen from above. b. Same, side view.  $\times 200$ .

Fig. 17. *Caudina ludwigi*, new species.

- a. Spinous table from posterior region seen from above. b. Same, side view. c. Spinous plate without spire.  $\times 120$ .

## PLATE 10.

Fig. 18. *Cucumaria ijimai*, new species.

- a, c. X-shaped rods from ventrum. b. Same in early developmental stage.  $\times 200$ .

Fig. 19. *Cucumaria lamperti*, new species.

- a. Large knobbed plate. b. Small smooth button with spines.  $\times 100$ .

Fig. 20. *Cucumaria spinosa*, new species.

- a. Typical button with one-holed, tail-like process. b. Same seen from side. c. Same in early developmental stage.  $\times 150$ .

Fig. 21. *Cucumaria sluiteri*, new species.

- a. X-shaped table-like deposit, side view. b. Same seen from above.  $\times 150$ .

Fig. 22. *Cucumaria constricta*, new species.

- a. Table-like button, side view. b. Same, from above.  $\times 150$ .

Fig. 23. *Thyone parva*, new species.

Spectacle-like body from superficial layer.  $\times 200$ .

Fig. 24. *Thyone bicornis*, new species.

- a. Table-like button from general perisome, side view. b. Same, from above.  
c. Button from pedicel, side view. d. Same, from above.  $\times 300$ .

Fig. 25. *Pseudocucumis watasei*, new species.

- a. Table-like deposit, seen obliquely from above. b. Same, from below.  $\times 200$ .

Fig. 26. *Pseudocucumis sagamiensis*, new species.

- a. Table-like deposit seen from above. b. Same, from side.  $\times 200$ .

Fig. 27. *Pseudocucumis tabulatus*, new species.

*a.* Table-like deposit seen from above. *b.* Same, from side. *c.* Same, from below.  $\times 200$ .

PLATE 11.

Fig. 28. *Phyllophorus cylindricus*, new species.

*a.* Table-like deposit seen from above. *b.* Same, from side.  $\times 150$ .

Fig. 29. *Phyllophorus glaucus*, new species.

*a.* Table-like deposit seen from side. *b.* Same, from above. *c.* Same, from below.  $\times 200$ .

Fig. 30. *Phyllophorus diomedææ*, new species.

*a.* Table-like deposit seen from above. *b.* Same, from side.  $\times 200$ .

Fig. 31. *Phyllophorus minutus*, new species.

*a.* Table-like button seen from above. *b.* Same, from side.  $\times 200$ .

Fig. 32. *Psolidium vitreum*, new species.

Knobbed plate from ventral sole.  $\times 200$ .

Fig. 33. *Psolidium bullatum*, new species.

Knobbed plate from ventral sole.  $\times 200$ .

Fig. 34. *Protankyra kagoshimensis*, new species.

*a.* Anchor. *b.* Anchor-plate.  $\times 80$ . *c.* Miliary granules.  $\times 200$ .

Fig. 35. *Toxodora pacifica*, new species.

Parenthesis-shaped deposits.  $\times 300$ .

Fig. 36. *Myriotrochus mitsukurii*, new species.

Spinous wheel from tentacle.  $\times 200$ .